

ENVIRONMENTAL ASSESSMENT TROUT CREEK SWAMP RESTORATION

**Deschutes National Forest
Sisters Ranger District**

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PURPOSE AND NEED

INTRODUCTION

This environmental analysis looks at a 76-acre project area that includes the 40-acre Trout Creek Swamp, a year-round wet meadow within the Why-chus Late-Successional Reserve. The swamp is located about 10 miles west of Sisters, in Deschutes County, Oregon, on the Sisters Ranger District of the Deschutes National Forest (Figure 1). The swamp is just south of Whispering Pines Campground, at the junction of Forest Roads 1018 and 1520.

The swamp currently is the home to a unique variety of plants and animals, including redband trout and several rare plants. The swamp is also an important source of clean water into the Trout Creek system. The Trout Creek Swamp Restoration Project proposes to use a combination of culvert replacement, vegetative manipulation, and riparian and stream restoration to meet Aquatic Conservation Strategy objectives and restore watershed function and diversity. The project will have long-term benefits that will improve watershed function and diversity.

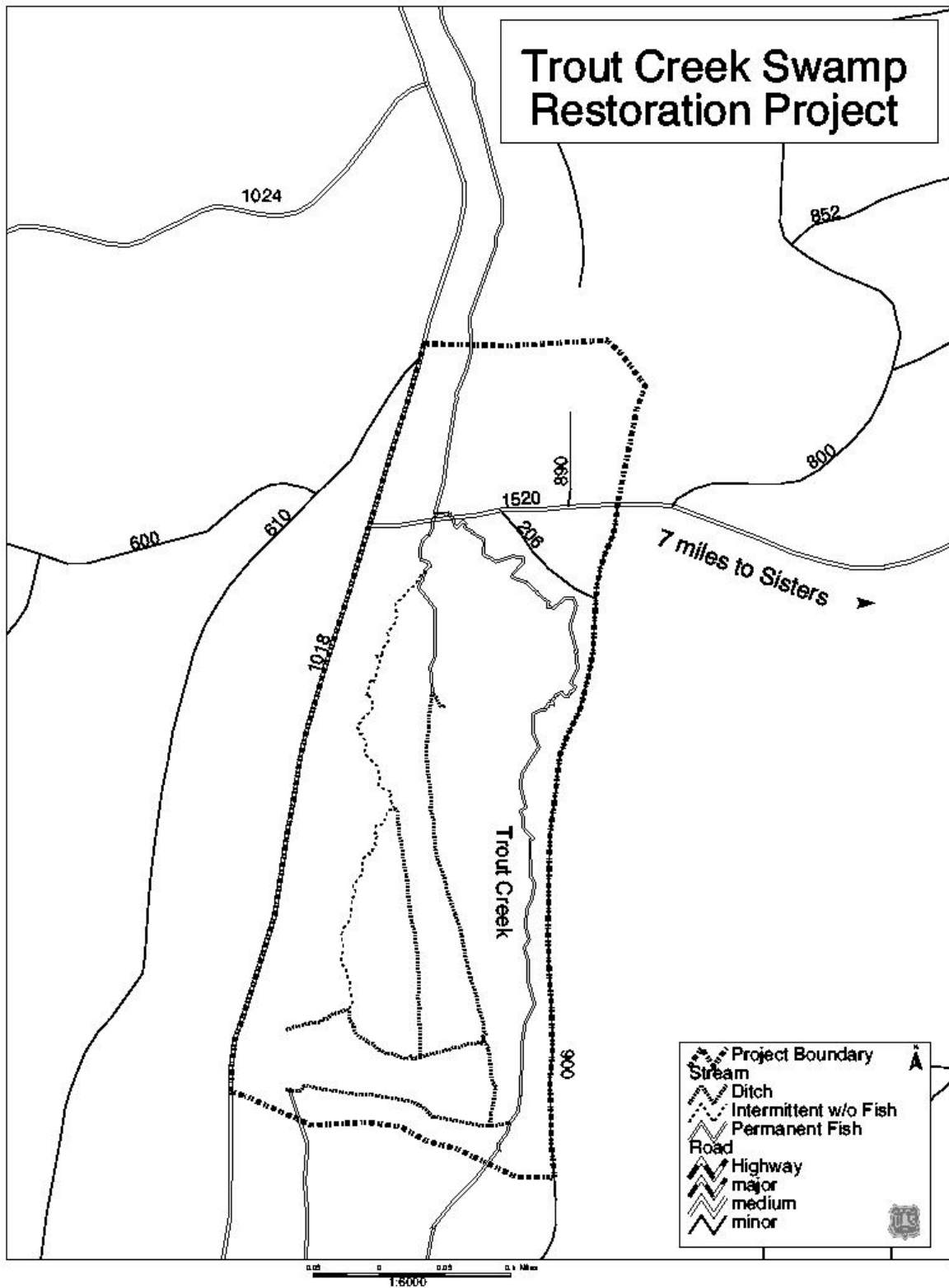
PURPOSE AND NEED FOR THE PROJECT

Yesterday's Actions In the early part of the last century, ranchers were looking for good summer pasture for their cattle at higher elevations, and worked hard on turning Trout Creek Swamp (then in private ownership) into grazing land. Following accepted practices at the time, they dug ditches through the swamp to channel the multiple meandering streams into a few deep, narrow ditches so that the water table would be lowered and there would be more dry areas for cattle to graze. Though this may have met the goals of the cattle ranchers, it resulted in many problems for the swamp ecosystem.

Today's Problems Ditches have changed how water flows through and is stored in the swamp (referred to as "hydrologic function"). This has caused several problems, including:

- The reduced ability of the swamp to hold water or act as a reservoir of cold, clean water for the Trout Creek system. A reduced water storage capacity also means greater extremes between high and low water flows downstream. Higher water flows can cause more erosion, and lower flows reduce the water available for plants and animals (such as the sensitive redband trout) and raise water temperature.
- The lowered water level and drier areas have allowed conifer trees to begin to grow in the swamp, slowly closing-in the meadow opening. Meadow habitats are relatively uncommon on the Sisters Ranger District, and there are several rare plants and animals that depend on these habitats.
- The ditches have been eroding (or "head cutting"), meaning that they have become a source of sediment pollution into Trout Creek.
- Reed canarygrass, an invasive non-native plant, may have been introduced into the swamp as forage for cattle and for erosion control. This plant appears to be out-competing many of the rare native plants.

Figure 1 – Location map



PROPOSED ACTIONS

The basic goal of this project will be to restore the natural hydrologic function of Trout Creek Swamp. The actions proposed to meet this goal include:

- Re-establishing historic, shallow stream channels through the interior of the swamp. The channels would be dug using mechanical means (e.g. spider backhoe).
- Replacing the culvert under Forest Road 1520, which allows water from the swamp to enter Trout Creek, with a larger, more “fish-friendly” design (a design that allows for upstream fish passage and more closely resembles the natural channel at bank-full flow).
- Filling in the ditches to prevent water from flowing back into these created channels. The ditches are long and deep and would likely require fill material brought in from outside the project area.
- Removing some of the conifers that are growing into the swamp. Tree removal could either be done by hand or with a mechanical harvester, or the trees could be chipped on-site. Downed trees could either be left on site to add woody debris to the swamp, or could be piled and burned if the downed material would cause a fire hazard. Hardwoods would also be re-established.
- Actively controlling the amount of reed canarygrass. This could be accomplished in a variety of ways, including burning, flaming, and by raising the water table.

Work would be planned for the driest time of year (August-October) to minimize impacts to the water quality.

DECISION TO BE MADE

The District Ranger will decide, based on the environmental analysis, which actions best achieve restoration of the swamp.

GUIDELINES FOR MANAGEMENT

There are several plans and assessments that provide guidelines for the Deschutes National Forest to restore aquatic and riparian areas. Restoring watersheds and hydrologic functions are top priorities on National Forest lands across the nation, and on the Deschutes National Forest. There is strong support for this type of project, as summarized in the guiding documents listed below. The information in these documents is incorporated into this Environmental Assessment (EA) by reference.

Deschutes National Forest Land and Resource Management Plan This plan was developed to guide all natural resource management activities and establish standards and guidelines on the Deschutes National Forest. This project will implement the Management Goals to: a) "Protect the unique and valuable characteristics of floodplain and riparian zones; maintain or enhance water quality and fish habitat; and b) Maintain or enhance soil productivity" (LRMP pgs. 4-2, 4-61, 4-67, 4-70).

Northwest Forest Plan (1994) (*Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl and Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related*

Species Within the Range of the Northern Spotted Owl.) This plan amends the Deschutes Forest Plan and provides standards and guidelines for management of late-successional and old-growth forest-related species within the range of the Northern Spotted Owl.

One of the primary objectives of the Northwest Forest Plan is to provide guidance on protecting and restoring aquatic and riparian ecosystems. This guidance is documented under the Aquatic Conservation Strategy, which lists nine objectives to help managers reach this goal. Objectives are addressed for the Trout Creek Swamp project under Environmental Consequences, Hydrology/Water Quality.

Why-chus Watershed Analysis (1998) The Why-chus Watershed Analysis provides an understanding of watershed conditions that help guide smaller scale projects such as this one. This watershed analysis assessed the current condition of watershed functions and processes, and recommends actions that may restore impaired functions. Trout Creek Swamp is referred to on pages 21, 98, 158, and 219, and the Watershed Analysis discusses the problems with the swamp and supports restoration efforts.

Why-chus Late-Successional Reserve Assessment (2001) Trout Creek Swamp is within the Why-chus Late-Successional Reserve, an area managed to provide, develop and maintain quality late-successional and old-growth habitats and ecosystems, and reduce the probability of losing these forest ecosystems to large-scale disturbances. Though the swamp is not late-successional habitat, it is desirable to provide areas of early seral habitat in the Late-Successional Reserve for diversity. Trout Creek Swamp is addressed in the Late-Successional Reserve Assessment as an area of altered hydrologic function, a noxious weed site, and a priority for restoration efforts (pgs. II-68, II-71, III-7, IV-10, IV-12, IV-34, IV-37).

PUBLIC INVOLVEMENT PROCESS

A letter was sent to the public on June 6, 2001. Articles regarding the project were printed in the local newspapers: *The Bulletin*, on June 9, 2001, and *The Nugget*, on July 4, July 11, and December 5, 2001. Seven comments were received during this period. Most commenters were in support of the proposed actions except for concerns about possible use of chemical herbicides to control the reed canarygrass. Two commenters were also concerned about the potential impacts to the quality of fishing, both within the ditches in the swamp and in Trout Creek. One commenter who was concerned about the impacts to fishing quality was also opposed to the “government” doing anything in the swamp area.

ISSUES

Based on input from the public, other local and state agencies and Forest Service specialists, key issues were identified. A key issue is a point of discussion that is debatable, disputable, or controversial, and that relates to the proposed action. Three issues were identified as key and were used in developing alternatives.

1. Access for Implementation of the Project

- There is concern that access for heavy vehicles/machinery into the swamp to re-establish new

channels, dig ponds along existing channels, haul in rock and material to fill existing channels, and to cut/chip and remove conifers will cause soil compaction, and will crush rare plants that grow in the meadow. The issue is how these short-term impacts related to providing access for vehicles / machines can be minimized during project implementation.

2. Aquatic Species, Water Quality and Hydrology

- There is a concern about short-term impacts on aquatic species (e.g. redband trout, amphibians) and water quality from machinery working in and around the existing channels and culvert. When the flow is diverted from the existing ditches to the re-established historic channels, fish in the swamp will likely become stranded and will need to be moved. There is a risk that some individual fish will die during this procedure.
- There is also concern about the long-term effectiveness of the proposed re-establishment of historic channels by filling the existing ditches. There is debate about whether the water will flow in the historic channels, where intended, or only end up flowing underground if the soils are too porous. Additional soil testing will be required to provide this missing information.

3. Invasive Plants

- The first concerns the best method for controlling the reed canarygrass, and perhaps more importantly, how to assure the proposed actions do not result in the plant spreading. There have been some observations that reed canarygrass may thrive in higher water tables.
- The second concerns the best method for disposing of the conifers that are encroaching into the swamp. There are costs and benefits with any disposal method. The methods that have been proposed involve driving a tracked vehicle to the trees and to cut and remove them, or felling and chipping (grinding) the standing trees on site, hand piling, or burning. The issue here is the best way to dispose of conifers while minimizing impacts to other resources.
- The last concerns the risk of introducing noxious weeds into the swamp brought in by the equipment/vehicles, fill material and horse use (mostly near the campground) during implementation.

ALTERNATIVES

This section presents a brief summary of reasonable and viable alternatives responding to the purpose and need. This section also includes a brief discussion of alternatives, which were considered but eliminated from detailed study.

ALTERNATIVE ACTIONS CONSIDERED BUT ELIMINATED FROM FURTHER DETAILED STUDY

1. Use only headgates or check dams to control water flow in the existing ditches. This action was considered because it would eliminate the need to import fill material into the project site to fill the created ditches. The benefits would be a reduction in the risk of introducing noxious weeds, a cost savings on material, and a reduced need for heavy equipment to haul fill material into the meadow, therefore reducing the potential impacts on soils and plants. However, this action was eliminated from further study because it was determined that the existing entrenched ditches would continue to intercept and route groundwater and overland flow, decreasing the likelihood of raising the water table. Additionally, maintenance to open and close a headgate would require someone to consistently be aware of the flow conditions at the swamp (for example, Big Marsh had a headgate that washed out because it was not opened during high flow). Check dams or headgates that “wash out” typically result in a “knick-point” that results in a head cut that works upstream, which lowers the water table more.
2. Haul cut conifers to where public could access the material for free firewood – The benefit of this action would be to increase utilization of the wood removed from the project area. This action was not analyzed in detail because the project site was considered too far from the population center of Sisters to attract firewood collectors; there were logistical concerns regarding where to stack the wood for free use, where additional resource impacts (e.g. to soil, water or plants) would occur from private vehicles used to haul the wood; and the potential fire risk of storing dead wood in piles near a popular recreation site. Piling some of the wood in the campground for use by campers may still be considered.
3. Use of herbicides on reed canarygrass – Herbicides can be a very effective method of controlling or reducing the amount of unwanted vegetation, and some herbicides have very low indirect impacts. However, this action was not analyzed in detail because of concerns by the public and the perceived risks of using herbicides in riparian areas (including potential impacts to humans, wildlife and other vegetation).

ALTERNATIVES EVALUATED IN DETAIL

Alternative 1 This is the no action alternative. The objective of this Alternative is to allow the processes and habitat cycles in the project area to continue largely without intervention. There would be no steps taken to actively alter hydrologic processes. Created ditches would not be filled or efforts made to slow the flow of water in the ditches. No actions would be taken to reestablish the historic channels. No actions would be taken to reduce the encroaching conifers or control reed canarygrass. The culvert under Forest Road 1520 would not be replaced.

Alternative 2 This is the Proposed Action. The objective would be to restore the natural hydrologic function of Trout Creek Swamp. The actions proposed to meet these goals include:

- *Created Ditches.* Fill in the ditches to prevent water from flowing back into these created channels. The ditches are long and deep and would require fill material from outside the project area. Some material would be from created ponds dug on the existing natural channels.
- *Historic Channels.* Re-establish natural, shallow stream channels through the interior of the swamp, following historic channels. The channels will be restored by a spider backhoe, and be approximately 2' wide and 6-12" deep.
- *Encroaching Conifers.* Remove some of the conifers that are growing into the swamp. Tree removal could either be done by hand or by mechanical means. Downed trees could either be left on site to add woody debris to the swamp, or could be piled and burned if the downed material would cause a fire hazard.
- *Reed Canarygrass.* Address containment of reed canarygrass through burning or flaming, and raising the water level in the swamp.
- *Culvert.* Replace the culvert under Forest Road 1520, which allows water from the swamp to enter Trout Creek, with a larger, more "fish-friendly" design. This would allow for upstream fish passage and would more closely resemble channel at bank-full flow.

Alternative 3 The objective is to minimize the use of machinery throughout the swamp in order to minimize physical impacts to plants and soils in the swamp.

- *Created Ditches.* The primary actions would focus on filling the created ditches using a combination of check dams built with rock, and fill material in between the dams. Some fill would be from ponds dug along the channels, some would be brought in from off-site sources. Machinery would only access the swamp by traveling along the existing channels. These access routes would be rehabilitated as the berms along the channels are sidecast into the channels for fill.
- *Historic Channels.* The historic channels would not actively be re-established (through digging). Instead, the higher water resulting from the raised water table would slowly re-establish the historic channels.
- *Encroaching Conifers.* Conifers would not actively be removed, but allowed to remain

standing. It is predicted that the higher water table would slowly kill (drown) standing trees.

- *Reed Canarygrass.* No direct action would be taken to control reed canarygrass.
- *Culvert.* The culvert under Forest Road 1520 would not be replaced.

Alternative 4 This alternative would use a combination of actions to meet the purpose and need for the project, similar to the proposed action alternative, except that where effective, actions would be modified to minimize impacts on swamp resources. In addition, a variety of methods to control the spread of reed canarygrass would be applied.

- *Created Ditches.* The created ditches would be filled in using the same actions as under Alternative 2.
- *Historic Channels.* Re-establishment of historic channels would be through mechanical means where impacts to soils and plants can be avoided, but through hand crews to dig trenches where there are concerns about impacts in order to protect soils and plants.
- *Encroaching Conifers.* A variety of methods would be used to dispose of the conifers, including pile burning at sites selected to minimize damage to rare and uncommon plants on the Swamp, and cutting and creating log piles to enhance wildlife habitat.
- *Reed Canarygrass.* Control of reed canarygrass would be addressed with a variety of methods, including burning or flaming the dense pocket of reed canarygrass, piling and burning some of the conifers on top of the reed canarygrass, clipping seed-heads, covering some with black plastic and then covering the plastic with soil/logs so it is not visible, and replanting willows to compete with the reed canarygrass. (There is some evidence that, when the water table was higher, willows inhabited the site where reed canarygrass is now growing.)
- *Culvert.* The culvert under Forest Road 1520 would be replaced using the same design objectives as under Alternative 2.

COMPARISON OF ALTERNATIVES

ALTERNATIVE ELEMENT	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4
Created Ditches - Action taken to prevent water from flowing back into these created channels	None	Yes –ditches filled	Yes – ditches partially obstructed with check dams and some fill	Yes – ditches filled
Historic Channels - Action taken to reestablish historic channels	None	Yes – Re-establish natural, shallow stream channels following historic channels. The channels would be dug with a spider backhoe to approximately 2' wide and 6-12" deep.	No – Predicted that the higher water resulting from the raised water table may slowly re-establish the historic channels.	Yes –Re-establish natural, shallow stream channels following historic channels. The channels would be dug to approximately 2' wide and 6-12" deep. Use mechanical means where impacts to soils and plants can be avoided, but use hand crews to dig trenches where there are concerns about mechanical impacts in order to protect soils and plants
Encroaching Conifers - Actions taken to prevent further encroachment	None	Yes - Remove some of the lodgepole pine trees through either hand or mechanical means. Downed trees primarily disposed of by piling and burning. Some piles left on site for wildlife habitat.	Yes – Though lodgepole pine would not actively be removed, it is predicted that the higher water table would slowly kill (drown) standing trees	Yes - Remove some of the lodgepole pine trees through either hand or mechanical means. Downed trees primarily disposed of by piling and burning. Some piles left on site for wildlife habitat.
Reed canarygrass - Actions taken to control future spread of the noxious weeds	None	Yes - Actively control reed canary-grass through burning and flaming	None	Yes – Actively control reed canary-grass through burning, flaming, piling and burning some of the conifers on top of the reed canarygrass, covering some with black plastic and soil/logs, and re-planting willows to compete with the reed canarygrass
Culvert under Forest Road 1520 - Replaced to allow for upstream fish passage, and to more closely resemble channel at bank-full flow.	None	Yes	None	Yes

MITIGATION AND ACTIONS COMMON TO ALL ACTION ALTERNATIVES

Protection of Soil and Water

- Use silt fences and erosion control devices to limit sediment during implementation.
- Plan implementation for the driest time of year (August-October) to minimize impacts to the water quality.
- Avoid equipment operations and foot traffic during periods of high soil moisture by planning activities during the dryer times of the year or by doing treatments over adequate snow and/or frozen ground
- After treatment, if soil monitoring indicates areas with detrimentally compacted soils, explore options for appropriate soil rehabilitation efforts
- Provide horse watering in the campground away from Trout Creek.
- Acquire 404 permit – coordinate water quality mitigation with State DEQ.

Protection of Fish and Wildlife

- For all action alternatives, machine work would be performed in the late summer/early fall to minimize erosion and transport of fine sediment. Fish would be removed from the channels that will be filled, and placed in the mainstem of Trout Creek.
- Leave some snags and taller stumps for wildlife habitat.
- Place down wood (larger diameter preferred) into swamp for habitat diversity.
- Place a few wood duck boxes in the project area. The district wildlife biologist will identify suitable locations.
- Plant willows and other hardwoods, where suitable, to diversify wildlife habitat.
- Provide piles of cut lodgepole pine for small rodents along edges of swamp.
- Northern Spotted Owl - Seasonally restrict activities between March 1 and September 30 unless a wildlife biologist determines a waiver is warranted. Any prescribed fire burn plans shall include smoke management objectives to minimize smoke dispersal to the southeast in the direction of the Trout Creek pair.
- Big Game - Seasonal Restriction between May 15 and June 30 for calving activities unless a wildlife biologist determines a waiver is warranted.
- Riparian/Neotropical Migratory Birds - Seasonal Restriction between April 15 and August 1 to allow nesting activities to be completed.

Protection of Native Plants and Prevention of Noxious Weed Spread

- Pre-disturbance surveys to identify sites occupied by uncommon bladderwort and moss species should be conducted to minimize impact to sites during excavations or fill operations.
- Fill material excavated from a site with reed canarygrass should be used only at fill sites

where reed canarygrass is already well established.

- Locate pile burns in selected mapped sites of reed canarygrass or in upland locations. Avoid sites with the uncommon native plant species.
- Avoid areas of reed canarygrass when locating new channel reestablishment.
- Before any extensive burning is implemented *on* the swamp, establish monitoring plots to determine 1) effectiveness of technique in control of target, and 2) impact on non-targeted native species, both vascular and non-vascular. Following treatment, monitoring on these plots should be conducted annually for three consecutive years. Evaluate monitoring results and discuss with district weed coordinator.
- Establish a practical monitoring system to assess changes in size and distribution of occurrences of reed canarygrass at the swamp.
- Limit accidental transport of weed seed by requiring clean equipment. Use contract and permit clauses to prevent the introduction or spread of noxious weeds. Ensure fill material is clean of noxious weeds and their seeds. Monitor compliance.
- Prevent new infestations during construction and maintenance. Do not stage equipment in weed-infested areas.
- Provide early detection and control. Monitor disturbed areas associated with the project for the next 1-3 years. Document and map any newly discovered sites and manually remove any new weed seedlings.

Protection of Recreation Access

- Post information in the campground about the project and timing of implementation. Re-route traffic and sign the alternate route at the junctions of Forest Road 1018 and Hwy 242, the junction of Forest Road 1500 and Hwy 242, and the junction of Forest Roads 1500 and 1520.
- If possible time the culvert replacement for September, after Labor Day weekend and prior to the beginning of rifle hunting season (early October).

AFFECTED ENVIRONMENT

GENERAL SITE DESCRIPTION

The project area is approximately 76 acres; the swamp covers about 40 acres, and the surrounding forest stands, roads and trails and Whispering Pines Campground cover the other 36 acres. Historically Trout Creek Swamp was a special habitat feature within the Late-Successional Reserve and did not contribute to the amount of large trees or multi-storied forest stands important for many species that are associated with late-successional habitat. The water table was historically too high to allow development of large structure. However, many of the species that inhabit surrounding forest stands are also very dependent on the open meadow habitat of Trout Creek Swamp for part of their lifecycle (primarily as a source of food and water). Numerous species associated with late-successional habitats are also very dependent on special riparian habitats like Trout Creek Swamp.

Forest stands surrounding the swamp are mostly mixed conifer and have an extensive number of trees larger than 21" diameter. Several old clear cuts are located within one mile in all directions. The clear cuts are dominated by pole-size ponderosa pine, manzanita, and grass.

The Swamp is not currently included within any Forest grazing allotment, active or vacant. Although grazing records specific to the Swamp are not readily available, grazing in the general vicinity dates from the late 1800s until at least the 1970s, and it is likely that grazing occurred on the swamp between the 1930s and 1970s. Local grazing animals in the past century included sheep, goats, cattle, and horses.

Historically the swamp expressed saturated water over a much larger area and later in the season than it currently does. Altered hydrological functions have allowed increased conifer occupation, which has lead to a further reduction in the level of water saturation. Remnants of willow, alder and cottonwood still exist but not at the levels that existed in the past.

HYDROLOGY/ WATER QUALITY

Trout Creek is located in the Trout Watershed (which is approximately 8,365 acres) and originates from springs in the mid and upper elevations of the watershed. It flows through a small riparian meadow area and pine forest. Trout Creek is a tributary to Indian Ford Creek but connects only during rare flood events (Why-chus Watershed Analysis, 1998). Trout Creek is in poor hydrologic condition due to dewatering of riparian meadows, intensive tree harvest in riparian zones, urban interface, and roads (Why-chus Watershed Analysis, 1998; personal field observations 6/24/99). Trout Creek Swamp has been highlighted as a high-priority restoration area. Restoring the swamp will increase water holding capacity, hydrologic function, and improve riparian habitat.

A survey of Trout Creek in 1990 by Straw and Riehle noted evidence of mudflows in the channel that was contributing fine sediment to the stream. The survey also noted extensive damage to the riparian zone from trails, high sediment from road problems, and a high degree of entrenchment. Horses commonly water in Trout Creek as it exits the swamp, by the north end of the culvert, resulting in sedimentation and denuding of riparian vegetation in this area.

The dewatering of the swamp has triggered a change from an aquatic ecosystem to a drier conifer ecosystem. The swamp has a reduced ability to hold water for the Trout Creek system. Reduced water storage capacity also means greater extremes between high and low water flows down stream. Higher flows have the potential to cause more erosion, while lower flows may increase stream temperatures and reduce the water available for plants and animals. An undersized culvert exists on the downstream end of Trout Creek Swamp. The culvert is a fish barrier and changes the hydrologic connectivity of the system. The undersized culvert acts as a barrier so that sensitive redband trout are unable to migrate upstream.

A discussion of how the existing condition of the project area meets the Aquatic Conservation Strategy (ACS) objectives can be found under the No Action Alternative description under the Environmental Consequences section, Hydrology/Water Quality.

PLANTS

Trout Creek Swamp has the characteristics of a fen, a peat-forming area receiving nutrients from both ground water and precipitation (Vitt, Marsh and Bovey, 1988). Although fens are an uncommon hydrological/biological feature on the Deschutes National Forest, the density of fens on the Forest is greater than that on adjacent Winema National Forest, and may be high relative to most other locations on the eastern flank of the Cascades as well. It appears that, per unit of surface area, these fens may be the most biodiverse plant communities on the Forest.

Historic ditching reduced the overall wetness in the swamp. The highest moisture level is at the southern end, and the lowest moisture levels are toward the northern end. Recent surveys by Deschutes National Forest botany staff, within and immediately adjacent to Trout Creek Swamp, have documented the presence of 110 species of vascular plants. Included are a number of species that are uncommon (largely due to limited habitat) in the Pacific Northwest. Examples of such species are cottongrass and four insectivorous plants: the great sundew, the round-leaved sundew, the flat-leaved bladderwort, and the lesser bladderwort. The lesser bladderwort is currently a US Forest Service Region 6 Sensitive Plant Species. The insectivorous bladders of bladderwort must be submersed in water to function, and cursory distributional surveys at the swamp suggest that bladderwort population density directly follows moisture gradients at the swamp.

Moss cover within the swamp, which also tends to follow the current moisture gradient, is extensive. The northern, drier portion of the swamp is dominated by the common wetland moss. However, in the drier sites, the moss *Drepanocladus vernicosus* becomes the dominant cryptogamic cover. Intermixed with these mosses are small amounts of the mosses *Tomenthypnum nitens* and *Meesia triquetra*. The presence of the latter three mosses at the swamp is very noteworthy. Each of these mosses is uncommon in the Pacific Northwest and would typically be found occurring together only in Canada.

Riparian vegetation along Trout Creek proper, north of the swamp and adjacent to the Whispering Pines Campground, is denuded due to high amounts of horse traffic to access water.

Unwanted and Invasive Vegetation. Aggressive non-native plants, or noxious weeds, can invade and displace native plant communities, causing long-lasting management problems. Noxious weeds can displace native vegetation, increase fire hazards, reduce the quality of recreational experiences, poison livestock, and replace wildlife forage. By simplifying complex plant communities, weeds reduce biological diversity and threaten rare habitats.

Figure 2 – Locations of Reed Canarygrass

Map available at Sisters Ranger Station

The noxious wetland weed reed canarygrass is conspicuously present at the swamp, but its history here is uncertain. It is known that at other wetland sites on the Forest, this grass has been intentionally introduced in an effort to enhance available forage. There is continuing discussion concerning the existence in North America of two types (with possible intermediates) of reed canarygrass: an aggressively invasive, non-native form vs. a non-invasive, native form. This discussion may be a moot point at Trout Creek Swamp. Although no monitoring of the populations at Trout Creek Swamp has occurred to date, the presence here of relatively large, pure stands of the grass and its stringer populations along the canals suggests that reed canarygrass populations at Trout Creek Swamp are actively expanding in area.

Reed canarygrass was mapped in the field using GPS (see Figure 2). Reed canarygrass is primarily located in the northern end of the swamp where two small concentrations of reed canarygrass are found. The distribution of reed canarygrass becomes patchy along the eastern side and southern side of the meadow. The middle and western side of the meadow was relatively free of reed canarygrass. The eastern ditch was lined with reed canarygrass but the central ditch and the natural channel on the western side was free of the weed. A total of 5.48 acres of reed canarygrass was mapped in the swamp.

Reed canarygrass spreads vegetatively by creeping, underground mats of rhizomes that support a very dense thicket of leaves and stems above ground. New sites are colonized by seeds. Stands of reed canarygrass exclude and displace desirable native plants, and areas invaded by reed canarygrass may be of reduced value to wildlife. The rhizomatous nature of reed canarygrass contributes significantly to the great difficulty typically associated with its control. Reed canarygrass may spread most aggressively in wetland settings, but can compete effectively in moist, fertile upland sites as well.

Small diameter lodgepole pine is also conspicuously present within the swamp. Its distribution appears to be inversely related to the moisture gradient within the swamp, with the density of trees greatest in the drier northern and central portions (where unmeasured densities appear to easily reach several hundred stems per acre), and lessening greatly in the damper southern portion. Most of the pine appears to be in the range of 3-5" diameter. Ring counts on several cut trees in the northern half of the swamp indicate that few of these trees are more than 20 years old. The apparent, relatively-recent invasion of the Swamp by these pines is at first surprising, given that the swamp was ditched 60-70 years ago. It seems quite possible that successful establishment of lodgepole pine coincided with the cessation of grazing in the swamp, perhaps about two decades ago.

FISH

Tributaries to the system above Trout Creek Swamp are limited to Alder Creek and springs that appear just upstream and at the head of the swamp. Flow of Trout Creek proper bypasses most of the swamp on the east side before collecting the water flowing through the swamp at the northern edge. From there, Trout Creek flows towards Sisters and connects with Indian Ford Creek. Due to the high infiltration rates and high permeability of the soils, Trout Creek rarely reaches Indian Ford Creek even in spring high flows (1 to 2 times every 15 to 20 years).

Trout Creek Swamp is located about three miles downstream of the Wilderness boundary. The swamp is partially drained through a series of ditches in and around its periphery. The springs that normally flowed through the swamp were rerouted to flow around the swamp and/or ditched into a main channel that was constructed through the middle of the swamp. Ditching the swamp and rerouting the

stream channel altered the natural hydrologic function of the swamp. Draining of the swamp has also affected habitat downstream by increasing peak flows during spring runoff and decreasing summer flows due to low water tables in the swamp.

Currently there is considerable horse traffic in Trout Creek adjacent to Whispering Pines Campground, because there is no other water source for horses. This activity results in sedimentation and widening of the channel and degrades fish habitat.

Redband trout are the only known trout species in Trout Creek. These trout are listed as a sensitive species for both USFS Region 6 and the State of Oregon. Electrofishing has produced fish up to 7¾ inches. Genetic analysis indicates that these fish are likely native redband (not related to hatchery fish). Brook trout are not known to inhabit the stream, indicating that Trout Creek is not tied to any high lakes in the Wilderness. Recreational fishing does occur within Trout Creek proper and within Trout Creek Swamp mostly by local residents and some campers from the horse camp located downstream of the swamp.

WILDLIFE

Threatened, Endangered and Sensitive Wildlife Three Federally-listed species have potential habitat within the project area.

Bald Eagle: There are no known bald eagle nests within five miles of the project area (Sisters Ranger District Survey files, 2000). The project area contains no significant foraging base for eagles, although numerous large diameter trees exist next to the project area with potential to be used as roost trees. If local fisheries were restored to the swamp area, the potential for foraging activities could be increased.

Bald eagle population levels currently exceed recovery goals for the Central Oregon area.

Lynx: The project area is outside of designated lynx denning, foraging, or travel habitat. Lodgepole pine habitats have the potential to be used as incidental foraging and cover for dispersing individuals. No sightings have been documented within the project area; in 1998 the Sisters Ranger District completed scent pad surveys, and no lynx were detected (Sisters Ranger District Survey files, 1998).

Northern Spotted Owl: The project area was surveyed to Regional protocol and the Trout Creek pair was identified in 1993. The nest has been monitored since that time (Sisters Ranger District Survey files, 1998 – 2001). The project area is within one mile of the Trout Creek pair. There are 1429 acres of nesting, roosting, and foraging habitat within 1.2 miles of the nest; and existing habitat is within U.S. Fish and Wildlife habitat thresholds. The Sisters Ranger District is within the recovery goals for spotted owls, and the project area has the potential to be used as foraging habitat. The swamp is small enough that spotted owls would use the meadow in an open condition or if it closes over due to conifer encroachment.

Regional Forester Sensitive Species, Forest Plan Indicator Species, and NW Forest Plan Survey and Manage Species

The species on these lists that have habitat potential in the project area are the peregrine falcon, greater sandhill crane, upland sandpiper, Townsend's big-eared bat, Pacific fisher, great grey owl, northern

goshawk, pileated woodpecker, pine marten, tri-colored black bird, and California wolverine.

The species which do not have habitat potential in the project area are long-billed curlew, horned grebe, harlequin duck, yellow rail, redneck grebe, bufflehead, pygmy rabbit, and sage grouse.

California Wolverine: In Oregon the wolverine is typically found in open forests at higher elevations (Csuti et al., 1997). Critical components to wolverine habitat seem to be an absence of human activity, ample big game, and low road densities (Butts, 1992). Wolverines are a forest carnivore and are considered an indicator of healthy forest ecosystems; they are associated with wild places (Hornocker and Hash, 1981). In the last century the distribution of this species has contracted considerably and they no longer occur throughout much of their historic range in the western United States. Habitat loss, through timber harvest, increased roading of forests, and general sensitivity to human disturbance, has been implicated in their decline (Banci, 1994).

Two camera bait stations were monitored in the vicinity of the project area in 1999; no wolverine use was identified (Sisters Ranger District Survey files, 1999). The project area has such a high level of human use that it is unlikely wolverine use the project area. Any use would be incidental and most likely associated with dispersal or travel activities.

Greater Sandhill Crane: In mountainous regions the sandhill crane inhabits isolated, well-watered river valleys, marshes, and meadows. Occasionally it inhabits relatively small marshes and patches of prairie in forested country. Cranes usually nest in or near shallow wetlands adjacent to feeding grounds. Nest sites are isolated from human disturbance and usually consist of a hay-like mound of grasses and sedges. During the breeding season, cranes forage within one mile of their nests. Foraging includes wheat, corn, alfalfa, sorghum, barley, roots and tubers, berries, small mammals, snakes, frogs, lizards, crickets, and grasshoppers (Csuti et al., 1997).

The level of human activity, distance to high-quality foraging sites, and current occupation of conifers in the swamp would preclude reproductive activity at Trout Creek Swamp. Formal surveys have not been conducted, and no sightings have been documented.

Townsend's Big-eared Bat: Maternity and hibernacula sites are associated with caves, mines, lava tubes, and buildings. Rimrock, cliffs, bridges, boulder fields, and possibly bark of large trees have the potential to be used as day roosts.

The project area has no known maternity roost or hibernacula sites within several miles. There are also no large rock structures, buildings, or bridges with potential for day roosting. The swamp area has a reduced function as habitat currently due to the conifer occupation and reduced amount of standing water. Openings in timbered areas with standing water association are prime foraging opportunities for Townsend's big-eared bats. Bats are known to travel long distances to foraging sites, so the project area has the potential to be used as a foraging area. Formal surveys have not been conducted.

Great Gray Owl: Great gray owls utilize large structure habitats associated with forested openings such as meadows and swamps. Nesting occurs in mixed-conifer large structure stands with foraging occurring in surrounding openings.

Although surveys in the area have not detected a nest, the project area provides excellent habitat. Survey efforts have resulted in great gray owl responses and activity in surrounding habitats (Sisters Ranger District Survey files, 2001). The encroachment of conifers in the swamp is reducing the habitat suitability for great gray owls.

Pileated Woodpecker: The pileated woodpecker is the Forest Plan management indicator species. East of the Cascade Mountains, both ponderosa pine and mixed-conifer forests are used, with the highest population densities normally in old-growth areas of sufficient size to support the birds (Bull et al., 1990; Thomas et al., 1979; Bull, 1975). Other habitat features important to this species include high (>60%) canopy closure, sufficient snags for feeding and nesting, and abundant down logs for foraging.

Primary habitats for pileated woodpeckers would occur in surrounding areas containing large structures; the swamp area would not have provided habitat. Incidental sightings are documented in areas surrounding the project area, but formal surveys have not been conducted.

Northern Goshawk: The northern goshawk is classified as a U.S. Fish and Wildlife Service, Category 2 species, and a State sensitive species. Goshawk nesting home ranges cover approximately 420 acres (includes the nest site, foraging area, and post-fledging family area) (Reynolds et al., 1991). Goshawks prefer open stands for foraging activities; however, for nesting they require canopy closures for protection from the weather and other raptor species. Goshawk nesting habitat is generally found within ¼ mile of a spring or smaller order stream. These sites provide higher canopy cover for nesting due to higher growth potential.

In 2000 the Sisters Ranger District surveyed Trout Creek Swamp and surrounding area for goshawk. One occupied nest was identified approximately 1½ miles east of the project area (Sisters Ranger District Survey files, 2000). At this time post-fledgling habitats have not been identified. The project area is within the larger 16,000 acres foraging areas used by goshawk. The swamp area has a reduced function as habitat currently due to the conifer occupation and lack of hardwood. Restoration of hardwood communities would benefit numerous prey species for goshawk.

Amphibians: The swamp provides habitat for a host of amphibian species. Habitat conditions include wet swampy conditions in the interior, gentle running water in three channels through the swamp, relatively gentle running water in Trout Creek, and numerous down logs and future potential for down logs due to the large structure dominated habitats to the north, east, and south. The swamp area has a reduced function as habitat currently due to the conifer occupation and reduced amount of standing water.

The results of a survey completed in 2000 include: one unknown egg mass with characteristics of a Cascades frog, spotted frog, or northwestern salamander on the south end of the swamp; one adult Cascade frog and several egg masses; several egg masses of Pacific tree frogs; and numerous tad poles (Sisters Ranger District Survey files, 2000).

Great Blue Heron: Great blue heron use nearly any meadow, grassland, marsh, riparian thicket, lake, river, or pond within every habitat type (Csuti et al., 1997). Nests are located in conifer or deciduous trees, usually associated with riparian habitats. They are colonial birds that nest in groups of a few to several hundred (Csuti et al., 1997).

Trout Creek Swamp has potential to be used for foraging activities by dispersing individuals. The swamp is relatively small and isolated from like habitats to provide large colonial nesting; however individual pairs might utilize the swamp for reproduction. The swamp area has a reduced function as habitat currently due to the conifer occupation and reduced amount of standing water. Returning fish populations to the small streams flowing through the meadow and increasing the amount of standing water would increase foraging potential.

Great blue heron have not been observed in the Trout Creek Swamp area (Sisters Ranger District Wildlife Sightings Files, 2000). Formal surveys have not been conducted.

Pine Marten: Marten are associated with mature forests with closed canopy at any elevation, but will wander through openings and even up into alpine areas (Csuti et al., 1997). The presence of down logs and vertical structure in a stand is important to habitat use.

Surrounding LSR habitats provide habitat. The edge of the swamp would provide foraging opportunities. Reduced diversity and amount of species associated with the swamp due to conifer encroachment and reduction of hardwoods has reduced the value as foraging habitat for pine marten.

Two camera/bait stations were installed in the vicinity of the project area in 1999. Both detected marten use in the area (Sisters Ranger District Survey files, 1999).

Peregrine Falcon: The falcon's most critical habitat component is the availability of suitable nest sites. Sites are usually large cliff faces in conjunction with riparian zones overlooking a fairly open area with an ample food supply (Csuti et al., 1997). Peregrine are very adaptable to human use patterns.

The project area has potential to be used as incidental foraging and migration habitat. The reduction of riparian hardwoods has reduced the carrying capacity for passerine birds. The use of DDT was the major cause of population decline for peregrine. DDT and other pesticide use that historically caused the species decline has been halted and the species is making an incredible recovery in the Northwest. Improving riparian conditions should increase the amount of prey species available within the analysis area.

There are no known peregrine nests in the analysis area (Sisters Ranger District Wildlife Sightings Files, 2001).

Pacific Fisher: Fisher primarily use mature, closed-canopy coniferous forests with some deciduous component, frequently along riparian corridors. The fisher is an opportunistic carnivore whose diet includes small rodents, rabbits, squirrels, porcupines, amphibians, reptiles, and birds and their eggs (Csuti et al., 1997). The project area provides high-quality foraging area with surrounding LSR habitats that provide necessary cover. The amount of roads and the campground north of the project area allow sufficient human disturbance to reduce habitat suitability.

Two camera/bait stations were installed in the vicinity of the project area in 1999; no fisher were detected. There have been no recorded sightings of fisher in or adjacent to the project area (Sisters Ranger District Survey files, 1999 -- 2001).

Tri-colored Black Bird: The blackbird breeds in freshwater marshes with emergent vegetation, in thickets of willows or other shrubs or in Himalayan blackberry bushes. Blackbirds are colonial rather than territorial, and defend an area only a few feet away from their nest. Colony locations vary and are unpredictable from year to year (Csuti et al., 1997). Habitat use at high elevations is rare (Terres, 1991).

The project area has limited potential for use due to its relatively small size and high elevation. Existing conifer encroachment is limiting the open marshy qualities desired. Formal surveys have not been conducted, and there have been no known sightings of tri-colored blackbirds within the analysis area.

Downed Logs and Snags

Downed logs and snags are important to many animals as foraging, denning, and breeding sites. Some animals that heavily use downed logs are the striped skunk, marten, wolverine, pileated woodpecker, and northern goshawk. Those that heavily use snags are the white-headed woodpecker, pileated woodpecker, pygmy nuthatch, brown creeper, flammulated owl, great gray owl, screech owl, and gray squirrel.

The amount of water available on the edges of the swamp allows large-diameter trees to grow and provide higher concentrations of very large trees that over time will become snags and down logs. The swamp itself, under wetter conditions, would not provide conifer snags; however, higher levels of cottonwood or aspen snags could be expected under more open, moist conditions. Cottonwood and aspen are important species to a number of neotropical migratory birds. Snags and down logs are a key component to alter hydrologic function within the swamp and provide microhabitats for many species. Surrounding habitats are being managed for LSR values, which include high concentrations of snags and down logs.

Big Game

Rocky Mountain elk and mule deer are species of special interest to public land users and, as such, are species with emphases in the Forest Plan. Both are present and use the project area for rutting, calving, and fawning.

Big game historically used riparian areas as key reproductive, foraging, and travel corridor sites. The high road densities associated with riparian areas are reducing the habitat security associated with the swamp. Open road densities are above 2 miles per square mile. This reduces habitat security and increases the potential for poaching.

Intensive timber harvesting in the past has increased the amount of forage available and increased the amount of edge habitats in the area. These are transitory habitats. Areas like Trout Creek Swamp historically were special habitats important during critical reproductive activities, especially for elk. Edge habitats provide hiding cover within accessible distances of foraging areas.

Riparian / Special Habitats (Neotropical Migrants)

Riparian areas currently and historically have provided the most diverse habitat and wildlife species complements within the watershed. 70% of terrestrial species on the forest rely on riparian zones for a portion of their habitat needs. Shrub conditions in riparian areas were especially critical due to the diversity of species that utilized these areas. Riparian areas in the watershed tend to have higher numbers of snags. These components in association with higher canopy closure levels allow riparian areas to function as connective (travel) habitat for a variety of species.

Many past activities have altered riparian conditions, including elimination of beaver, alteration of the hydrological function of streams, removal of natural fire, timber harvest, roading, dispersed recreation and camping, and excessive grazing of cattle. These alterations have affected the ability of the area to support many of the plant species and thus habitats that once occurred in the riparian zones.

The conversion of the swamp area from an open moist habitat with high levels of hardwood species to a conifer-dominated drier habitat has reduced the carrying capacity for neotropical migratory birds.

Conifer encroachment has reduced the amount of aspen and hardwood habitats. Without some management intervention these habitats will be drastically below historic levels. The lack of hardwood vegetation is limiting the ability of beaver to expand their distribution.

SOILS

Trout Creek Swamp occurs on an area of glacial till that has been covered by volcanic ash. Flooding in the area has reworked this ash, and riparian vegetation has formed an organic soil layer over the mineral soils. Soils in Trout Creek Swamp are broadly classified as Land Type 5 in the Deschutes National Forest Soil Resource Inventory (Larson, 1976); this type has wet, non-forested areas, including meadows, depressions, and swampy areas. Limited field observation of soils, topography and vegetation in the project area indicate that several different soil-vegetation types exist. The majority of the swamp consists of grass and sedge forming a thin organic soil horizon over mineral soils of a sandy loam texture. Two smaller areas were identified as having a slightly higher landscape position (approximately 6 inches higher in elevation) and supporting reed canarygrass. This type probably has a coarse soil texture with a high percentage of gravels and likely supported a willow rather than a grass-sedge plant community. A third type, the spruce bog, located on the south of the swamp, has soils with a forest litter duff layer over a thick organic soil horizon and sandy loam subsoil. All of the soil types have seasonal or year around water tables.

In the 1930s a road was constructed at the north end of the swamp by filling in low areas and installing a culvert. At about this same time, ditches were dug in the swamp to assist with draining water to provide better conditions for cattle grazing. These ditches appear to be eroding, most likely during spring runoff periods. Several head cuts in the ditches have been observed. In addition, lowered water tables caused by ditching have allowed conifer trees less than 20 years old to invade much of the area that was originally swamp. Areas that were probably willow have been invaded by reed canarygrass, with only occasional very old and or dead willow still remaining. Out of the three soil-vegetation types identified, the spruce bogs appear to be in the best existing condition, with healthy trees and minimum sign of disturbance.

RECREATION AND SCENIC RESOURCES

Recreation. Primary recreation use within the project consists of groups camping with horses in the Whispering Pines Campground, and horse travel along roadways and trails. Forest Road 900, upland along the east side of the swamp, has been closed to motorized vehicles and is a popular access for horseback riders toward Scott Pass Trailhead, and into the Wilderness. Observations during the analysis did not identify any evidence of vehicle use along Road 900 or indirect impacts from horse use to the swamp or Trout Creek.

Whispering Pines Campground is a rustic development, attracting visitors who want to be in more quiet, undeveloped settings, and who want a good staging area for access to the Wilderness trails. Developments include vault toilets, designated parking/camping areas, and corrals. Average occupancy during the use season (May through November) is approximately 20 to 30%, with close to full occupancy on midsummer weekends and holidays.

The only other recreation use is a small amount of fishing in the ditches in the swamp and within

Trout Creek for native redband trout. The users are primarily local residents looking for a fishing experience that is not as restrictive as on the Metolius River (where only fly-fishing is permitted) and where they won't encounter as many other recreationists. Two people expressed concerns during this analysis about potential impacts to the quality of fishing in the ditches and within the creek. The primary concern was that this fishing opportunity would be lost and people would need to find substitute settings in which to fish.

There is little evidence of human use in the swamp. Thick vegetation surrounding the swamp edges and standing water in the swamp for most of the year likely discourage human use.

Scenic Resources. Trout Creek Swamp provides diversity in an otherwise homogeneous landscape of dense, dry forest stands. It provides variation in color, texture and form, and is a relatively unique feature in the Eastern Cascade forests. Conifers are encroaching on the swamp, resulting in the swamp opening becoming smaller. These conifers, and the spreading expanse of reed canarygrass in the meadow, are reducing the scenic diversity within the swamp.

HERITAGE RESOURCES

One site with both a prehistoric and an historic component is present at the north end of the project area, in and around the campground. The site has had multiple impacts to both components and has been evaluated as not eligible for the National Register of Historic Places. The swamp proper was identified on early maps (circa 1920s) as a site for a reservoir, but this reference disappears on more recent maps and there is no indication that a reservoir was ever built. The entire project area has been intensively surveyed, with the exception of swampy areas with standing water.

ENVIRONMENTAL CONSEQUENCES

This section discloses environmental consequences expected as a result of Alternative 1 (No Action) and the action Alternatives 2, 3, and 4. This section provides the scientific and analytic basis for comparison of the alternatives. It also describes the direct, indirect and cumulative effects of the alternatives, while addressing the issues as listed on pages 7-8.

EFFECTS ON HYDROLOGY/WATER QUALITY AND AQUATIC CONSERVATION STRATEGY OBJECTIVES

Alternative 1 - The no action alternative will result in continued degradation of the Trout Creek Swamp aquatic ecosystem. Down-cutting will continue to work upstream through the swamp, resulting in increased erosion and lowering of the water table. By lowering the current water table, less water is retained within the swamp and the ability of the system to support riparian/wetland plant species and provide consistent flows throughout the year is diminished. (Encroachment of conifers will continue.) Continued erosion may lead to a violation of state water quality standards. Elevated stream temperatures and higher sediment levels may affect aquatic species, and horse watering in Trout Creek below the swamp will continue to increase turbidity and sediment and denude riparian vegetation. Fish passage will continue to be hindered by the lack of a culvert.

Alternative 2 - This alternative is predicted to be more effective than Alternatives 1 and 3 in restoring the natural hydrologic function of Trout Creek Swamp through active restoration. A new channel(s) would be constructed with specified dimension, pattern, and profile to aid in restoring the historic water table. The new channel(s) would incorporate appropriate channel dimensions to slow water velocity, promote water retention within the swamp, and restore historic floodplains so that in times of high flow, water would “spill” onto the floodplains where vegetation would decrease the erosive power of the water. Currently, the ditches have downcut enough that high flow events do not spill onto the floodplains. (Consequently, high flow events are concentrated within the ditch and the high erosive power of the water may cause the ditch to downcut further, which may lower the water table even more.)

Additionally under this alternative, old channels would be filled to prevent interception and routing of groundwater and overland flow. There may be some short-term disturbance during the restoration process, such as an increase in sediments as water is directed back into the re-established historic channel(s) and the culvert is replaced. However, there are expected to be no measurable, adverse, long-term effects from these activities. A new culvert will promote fish passage and decrease current water velocities to reduce erosion. The short-term impacts would be mitigated by actions discussed on pages 13-14. Sediment into Trout Creek would be reduced adjacent to the campground with the addition of a horse-watering trough away from the stream. This alternative is likely to meet the desired conditions and restore a healthy aquatic ecosystem.

Alternative 3 – This alternative would attempt to restore the natural hydrologic function of Trout Creek Swamp through part active and part passive restoration. Under this alternative, the created ditches would be filled in and spring water would be allowed to flow freely into Trout Creek Swamp. New channel(s) would not be dug to route stream flow. Water would flow freely over the swamp and over time may return to historic channels or form new channel(s). As water from the springs spreads

across the swamp, there is a question whether there will be enough shear stress to reform the historical channel(s), as most spring water will be of low velocity and historic channels are completely revegetated. There is risk that the water may cut back into the filled ditches before they become revegetated. There is also risk that “sheet flow” over the swamp could result in water temperature problems. Reed canarygrass and conifers may drown once water returns to the swamp, but no active restoration will be taken. However, observations provided by Jonathan Freedman, US Environmental Protection Agency, indicated that reed canarygrass may not be controlled without human intervention. This alternative would not replace the undersized culvert and therefore a barrier to fish passage would continue to exist. Additionally, fine sediments would continue to be put into the stream system. Sediment into Trout Creek would be reduced adjacent to the campground due to the addition of a horse-watering trough away from the stream.

Alternative 4 – This alternative is predicted to be as effective as Alternative 2 in restoring the natural hydrologic function of Trout Creek Swamp. This alternative uses less mechanical methods than Alternative 2 but more than Alternative 3. Work crews (crews of 10 to 20 people) would do most of the digging in the historic channel to decrease the degree of soil compaction. Work crews would also perform in sensitive areas. However, work crews may impact the soil more than that of a spider backhoe because of the concentration of people in a small area for a longer period of time. Soil compaction may negatively affect restoration of the swamp’s hydrologic function. This alternative would promote fish passage through replacing the culvert. Sediment into Trout Creek would be reduced adjacent to the campground with the addition of a horse-watering trough away from the stream.

Aquatic Conservation Strategy

This section discusses to what extent each alternative addresses the intent of the Northwest Forest Plan Aquatic Conservation Strategy (ACS) Objectives.

ACS Objective 1: Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted.

Alternative 1 - The no action alternative will not maintain or restore the aquatic system. There is a loss of the distribution, diversity and complexity of watershed and landscape-scale features. Dencutting in the drainage ditches will continue to lower the water table and dewater the swamp. The culvert will continue to add fine sediments to the stream system, and horse watering will continue to degrade riparian vegetation and stream banks below the culvert. Alternative 1 does not meet this objective.

Alternative 3 - Alternative 3 would provide some degree of restoration to the aquatic system. Dewatering of the swamp would discontinue by filling the existing ditches. However, fish passage, fine sediment inputs, and dencutting would remain a problem without replacing the existing culvert. This alternative would not ensure protection of the aquatic system.

Alternatives 2 and 4 – These alternatives would provide some degree of restoration to the aquatic system. They would attempt to restore and maintain the distribution, complexity, and diversity of watershed and landscape-scale features by restoring historic channels. On a watershed and landscape scale, Alternatives 2 and 4 are consistent with ACS Objective 1.

ACS Objective 2: Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include flood plains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species.

Alternatives 1 and 3 - Alternatives 1 and 3 do not include removal of the undersized culvert at the swamp outlet, so this culvert will continue to be a barrier to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species. Alternatives 1 and 3 do not meet this objective.

Alternatives 2 and 4 - These alternatives will replace the undersized culvert, restoring connectivity between critical habitat areas for aquatic species (including redband trout). These alternatives meet the intent of ACS Objective 2.

ACS Objective 3: Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.

Alternative 1 - Horse traffic in Trout Creek adjacent to the campground has resulted in bank degradation and widening of the channel. As a result, natural channel forms, including shorelines, banks and bottom configurations, have been degraded. In addition, high velocity waters that run through the existing culvert will continue to erode the channel and add fine sediments to the aquatic system. The no action alternative does not restore the physical integrity of the aquatic system. Alternative 1 does not meet the intent of the ACS.

Alternative 3 - Alternative 3 provides measures that will enhance and improve the physical integrity of the aquatic system. Alternative 3, however, does not replace the undersized culvert; thus, it does not completely restore the physical integrity of the aquatic system. Alternative 3 does not meet the intent of ACS Objective 3.

Alternatives 2 and 4 - Alternatives 2 and 4 will provide increased protection to the aquatic system. Restoration of the historic channel will improve the physical integrity of the aquatic system by recreating natural shorelines, banks, and bottom configurations. In addition, providing a horse-watering trough away from the stream will help protect the stream banks from trampling. Both alternatives would restore shorelines, banks, and bottom configurations. These alternatives meet the intent of ACS Objective 3.

ACS Objective 4: Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.

Alternative 1 - The no action alternative does not restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. This alternative allows the continued downcutting of the stream, causing increased sediment aggradation downstream. Downcutting will also continue to lower the water table, promote conifer encroachment, lower the water table, and reduce water storage in the swamp. Reduced flows from the swamp during summer months could result in a stream temperature problem. Alternative 1 does not meet the intent of ACS Objective 4.

Alternative 3 - Alternative 3 provides some restoration that may improve flow timing, water temperatures, and water retention in the swamp. However, without replacing the undersized culvert,

the system may continue to degrade as in Alternative 1. Increased water velocities through the undersized culvert will continue to erode the channel bed. Alternative 3 does not meet the intent of ACS Objective 4.

Alternatives 2 and 4 - Alternatives 2 and 4 will attempt to move the water out of drainage ditches into the swamp. The natural stream channel(s) will provide an environment necessary to support healthy riparian, aquatic, and wetland ecosystems. There may be some short-term sediment input into the aquatic system from creating new channels and replacing the culvert. The effects from these activities will remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities. Alternatives 2 and 4 meet the intent of ACS Objective 4.

ACS Objective 5: Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.

Alternative 1 - Alternative 1 would not restore the sediment regime under which the aquatic ecosystem evolved. All of the elements of the sediment regime, including the timing, volume, rate, and character of sediment input, storage, and transport have been altered. Down-cutting has eliminated the stream's access to flood plains, and in times of high flow all water is concentrated in the down-cut channel. The channel capacity has changed, leading to a greater erosive force. This alternative allows the continued down-cutting of the stream, causing increased sediment in the system. In addition, horse traffic and the existing culvert will continue to result in further sedimentation. Alternative 1 does not meet the intent of ACS Objective 5.

Alternative 3 - Alternative 3 provides some restoration of the aquatic system. However, without replacing the undersized culvert, the system may continue to further degrade. This alternative does not meet the intent of ACS Objective 5.

Alternatives 2 and 4 - These alternatives meet the intent of Objective 5 by restoring the sediment regime under which the aquatic ecosystem evolved. As previously mentioned, there may be some short-term sediment inputs into the aquatic system, but there are expected to be no measurable adverse long-term effects.

ACS Objective 6: Maintain and restore in-stream flows sufficient to create and restore riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration and spatial distribution of peak, high, and low flows must be protected.

Alternative 1 - Alternative 1 does not restore in-stream flows sufficient to create and restore riparian, aquatic, and wetland habitats. Drainage ditches have increased the magnitude and timing of peak flows and the low flows have decreased. There is currently no stream flow and flood plain interaction and wetland habitat are degrading. This alternative does not meet ACS Objective 6.

Alternative 3 - This alternative does not directly restore in-stream flows, primarily due to the culvert not being replaced. The undersized culvert is a limitation on restoring in-stream flows. This alternative does not meet ACS Objective 6.

Alternatives 2 and 4 - Alternatives 2 and 4 will attempt to restore in-stream flows to historical levels. These alternatives will re-establish historic channels. Historic channels will attempt to reduce water velocities and restore the historic water table. There is speculation that the created channels will continue to dewater the swamp, although channel dimension, pattern, and profile design will address

water retention. In-stream flows will be sufficient to restore riparian, aquatic, and wetland habitats. These alternatives meet the intent of ACS Objective 6.

ACS Objective 7: Maintain and restore timing, variability, and duration of flood plain inundation and water table elevation in meadows and wetlands.

Alternative 1 - Alternative 1 does not restore the inundation of the flood plain. The existing flood plain is inactive due to downcutting, and the water table elevation has dropped. Alternative 1 does not meet the intent of ACS Objective 7.

Alternatives 2, 3, and 4 - These alternatives will fill in drainage ditches and aid with inundation of the flood plain; they will have favorable effects on flood plains and water table elevations in meadows and wetlands. These alternatives will meet ACS Objective 7.

ACS Objective 8: Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distribution of coarse woody debris sufficient to sustain physical complexity and stability.

Alternative 1 - Alternative 1 would maintain current conditions. The species composition has changed from wetland to conifers due to lowering of the water table and the persistent noxious weed, reed canarygrass, has been introduced. There is no nutrient filtering due to the lack of connectivity between stream and flood plain. Channel migration has decreased and bank erosion has increased. Alternative 1 does not meet the intent of ACS Objective 8.

Alternative 3 - This alternative will not actively remove non-native species from the swamp. Without active control of reed canarygrass, native wetland species are less likely to return. Alternative 3 does not meet the intent of ACS Objective 8.

Alternatives 2 and 4 - These alternatives would meet the intent of Objective 8 by attempting to remove and control non-native species, restoring riparian vegetation in disturbed areas, and reducing sediment inputs to lower levels than present.

ACS Objective 9: Maintain and restore habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species.

Alternative 1 - The decrease in wetland habitat has reduced the population of native plants and other riparian-dependent species. The undersized culvert restricts fish passage and distribution of redband trout. Alternative 1 does not meet this objective.

Alternative 3 - Alternative 3 is not as effective as Alternatives 2 or 4 in restoring well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species. Reed canarygrass may continue to out-compete native plants, and the undersized culvert will continue to block the distribution of redband trout. Alternative 3 does not meet this objective.

Alternatives 2 and 4 - Alternatives 2 and 4 meet the intent of ACS Objective 9. The Alternatives will restore riparian habitat through actively removing conifers and non-native species, and replacing the undersized culvert. Restoration efforts will attempt to restore natural habitat.

Discussion

The no action alternative and Alternative 3 would not fully meet Aquatic Conservation Strategy objectives. However, Alternative 3 would meet ACS objectives if the culvert were to be replaced. Implementation of Alternative 2, the proposed action alternative, will help move the ecosystem toward the goals and objectives of the ACS and the Northwest Forest Plan. Alternative 4 also meets the ACS Objectives; however it may take more time and greater management of work crews to implement.

EFFECTS ON PLANTS

Two plant species are of special concern in considering the potential effects associated with the four alternatives developed for Trout Creek Swamp. These are the lesser bladderwort and reed canarygrass.

Lesser Bladderwort

Alternative 1 - No direct effect is anticipated. The occurrence of undesirable indirect effects appears probable. The extent to which the lesser bladderwort is nutritionally reliant on insectivory is uncertain. It appears able to exist for extended periods during the summer on soil that is mucky-wet, but not covered with water. Nevertheless, its habit of aquatic insectivory and its highly dissected leaves, indicate adaptation for at least partial submersion of the plant. This noted, it appears very probable that the geographic extent of suitable (vs. marginal) habitat for this species at Trout Creek Swamp decreased following ditching of the swamp. Similarly, it appears likely that the extent of suitable habitat for the uncommon mosses *T. nitens*, *Bryum weigeli*, and *D. vernicosus* has decreased following ditching of the Swamp. Further, it appears possible that the general level of the water table in the swamp, and in turn the extent of suitable habitat for the bladderwort and uncommon mosses, will continue to decline if reed canarygrass and lodgepole pine continue to increase their presence here. It also appears likely that expanding populations of reed canarygrass, and to a lesser degree lodgepole pine, may periodically physically overrun and displace local occurrences of lesser bladderwort and other native plant species, vascular and nonvascular, uncommon and otherwise.

Cumulatively, encroachment by reed canarygrass and lodgepole pine causes an adverse impact on lesser bladderwort. This follows the predicted adverse effects caused by ditching and, possibly, grazing. The status of lesser bladderwort at other sites on Deschutes National Forest where it may occur is unknown.

Effects Common to Alternatives 2-4 - Any success toward restoring natural hydrological function at Trout Creek Swamp is likely to promote an increase in suitable habitat for lesser bladderwort and the three uncommon mosses. The principal cause of this will be the raised water table. Indirectly, the raised water table may also impede the establishment of new lodgepole pine and weaken or kill some portion of the existing lodgepole pine, which can be a competitor to the lesser bladderwort and other native plant species.

Cumulatively, each of these alternatives offers some reversal of a series of negative impacts, on lesser bladderwort, caused by ditching, grazing, and encroachment by reed canarygrass and lodgepole pine.

Alternatives 2 and 4 - For lesser bladderwort, the anticipated effects of these two alternatives are similar. Among the four alternatives under consideration, these two represent the greatest effort to

restore natural hydrological function to Trout Creek Swamp. As such, they appear to offer (relative to Alternatives 1 and 3) the greatest potential to benefit lesser bladderwort plants that currently, because of lowered water table, occupy marginally suitable sites. Conversely, these Alternatives, with their more aggressive approach to restoring natural hydrological conditions (use of a spider backhoe, excavations to reestablish historic channels and to acquire fill material), pose risk of damage or destruction of undetected local populations of the lesser bladderwort and other uncommon native plant species. To the extent desired, this situation can be seen as a tradeoff between a short-term risk to individual plants vs. a potential long-term benefit to the species through creation of additional suitable habitat. The risk of such undesirable impacts can be, however, minimized by pre-excavation plant surveys. Alternative 4, which allows for manual (vs. spider backhoe) reconstruction of historic channels where impacts to local plant populations is a concern, offers somewhat reduced risk of damage to existing local populations of lesser bladderwort and other uncommon native plant species relative to Alternative 2.

The use of fire at Trout Creek Swamp, whether in efforts to control reed canarygrass or lodgepole pine, poses a direct risk to existing lesser bladderwort plants and other uncommon native plants. As above, pre-activity plant surveys in sites proposed for burning should help reduce the risk of direct damage to lesser bladderwort plants, and the tradeoff rationale, which in this instance is risk vs. decreased competition, again applies.

The indirect effects anticipated with these alternatives are largely beneficial to the lesser bladderwort and other uncommon native plants. Restoration toward some original hydrological condition should generally raise the water table and, in turn, increase the amount of area over which these plants can become established. Likewise, direct actions to reduce the extent of reed canarygrass and lodgepole pine populations, particularly the former, promises to reduce competition by these species for space occupied by the uncommon native plants.

Alternative 3 - The direct effects associated with this alternative appear to have less potential for benefit to lesser bladderwort and the other uncommon native plants than do those associated with Alternatives 2 and 4. This Alternative's less aggressive effort to reestablish historical hydrological conditions appears likely to result in a generally lower water table across Trout Creek Swamp than that likely to be achieved by Alternatives 2 and 4. The risk of accidental, mechanical destruction of lesser bladderwort and the uncommon mosses promises to be reduced in this Alternative, but this may be offset by the lesser amount, relative to Alternatives 2 and 4, of new acreage available for establishment of these plants, and potentially, the lessened reduction in competition between these plants and reed canarygrass.

The indirect effects anticipated with this Alternative also appear to have less potential for benefit to lesser bladderwort and other uncommon native plants than do those associated with Alternatives 2 and 4. This alternative calls for essentially no direct action on encroaching reed canarygrass and lodgepole pine. A somewhat elevated water table may reduce the rate of encroachment by lodgepole pine but it appears unlikely to have any negative effect on reed canarygrass. The anticipated continued expansion of reed canarygrass populations under this alternative poses a growing threat to sites currently occupied by uncommon native plants.

Reed Canarygrass

Alternative 1 - No direct effects to reed canarygrass are anticipated under this Alternative; indirect effects include a continued expansion in the amount of area covered by reed canarygrass at Trout Creek Swamp. Over time, this will result in a reduction in the extent of area covered by numerous native plant species, the lesser bladderwort included. Reed canarygrass can cause a loss of lesser bladderwort sites by physically overrunning them, but perhaps also by locally lowering the water table through high rates of evapotranspiration.

Alternative 3 - Inadvertent spread of reed canarygrass can accompany excavation to provide fill material for canals. This spread would probably be within a meter or two of existing plants if fill for canals was generated by sidecasting of canal berms. Fill acquired by excavation at sites within Trout Creek Swamp that are not immediately adjacent to a canal run the risk of longer distance transport and establishment of reed canarygrass. Plant surveys at any remote sites targeted for excavation should reduce the risk of accidental transport of reed canarygrass.

Little indirect effect on reed canarygrass is anticipated. Although some general elevation of the swamp water table is anticipated with this alternative, the literature addressing reed canarygrass control suggests that only deep and prolonged inundation is likely to have a extensive adverse impact on reed canarygrass. Such inundation is not feasible at Trout Creek Swamp.

Alternatives 2 and 4 - The effects anticipated with these two alternatives are similar for reed canarygrass. The risk of accidental spread of reed canarygrass during the hydrology-related excavations under these alternatives is greater than that under Alternative 3. This is because the amount of excavation will be larger, as more complete filling of the canals is planned, and historic natural channels will be shallowly excavated. It will be particularly important, under these alternatives, to perform pre-disturbance surveys for reed canarygrass at sites planned for fill-generating excavations.

Only Alternatives 2 and 4 call for direct action against reed canarygrass. As such, they offer the only clear opportunity to affect a negative impact on this weed. Review of literature addressing reed canarygrass control, and personal communications with individuals actively working with reed canarygrass, has reinforced three general expectations: 1) Eradication of large, well-established populations of reed canarygrass (such as exist at Trout Creek Swamp) is an unreasonable goal; *control* (curbing its spread) will be difficult. 2) Use of a combination of control techniques increases the prospects for success. 3) Success requires repeated efforts over an extended period of time. For this reason, Alternative 4 may be more effective in controlling reed canarygrass than Alternative 2. A list of the most common actions applied to control of this weed, with brief notes on each, follows.

Herbicides. Alone or frequently in combination with other means, herbicides are almost certainly the single most valuable tool in efforts to control reed canarygrass. Rodeo (glyphosate), an herbicide approved for use by the Forest Service in wetlands, has a very impressive record of success against this weed, but at this time, herbicides are not under consideration as a management tool for controlling reed canarygrass at Trout Creek Swamp.

Discing. This is an effective means of damaging the extensive rhizome systems that are a key to reed canarygrass tenacity and invasiveness. Effectiveness is greatly increased if preceded by herbicide

treatment. However, application of this technique could have negative impacts to sensitive plant communities in Trout Creek Swamp.

Inundation. Forest Service and other studies have shown this to be an effective means of reed canarygrass control. The depth and periods of inundation associated with success in these studies is not feasible, however, at Trout Creek Swamp.

Burning. This technique is most effective at sites where reed canarygrass is mixed with desirable/native species. The presence of these other plant species and their seed banks promotes competition with reed canarygrass as vegetation reestablishes itself at the burn site. Late spring, just before flowering, is the best time for burning. Fall burnings can also be effective, but early-spring burning can promote the spread of reed canarygrass. Where more selective treatment is desired, flaming may be most appropriate. Burning and flaming are tools that have potential for application at Trout Creek Swamp; the use of burning needs to be tested on trial plots before broader-scale application is implemented.

Mechanical. Manual pulling can be effective with sufficient repeat visits, but is so labor-intensive that it is practical only on very small populations. This is generally not practical at Trout Creek Swamp. Covering reed canarygrass with black plastic tarps for two or more years appears to have mixed success. Trials with this technique applied to small, well-defined pockets of reed canarygrass would be appropriate.

Clipping. The effectiveness of clipping seems directly related to number of repeat visits per season. Although very labor intensive, this technique might be tested on small, readily accessible pockets of reed canarygrass. It may be most effectively applied to flowering stems as a means of reducing seed production within a stand.

Burying. Covering reed canarygrass with material that restricts air flow, such as with black plastic, is expected to effectively suffocate the area covered. This method will be tried under Alternative 4.

Other Invasive Plants

Alternative 1 – Under this alternative there is little risk of introducing other invasive plants into the project area. However, a continued increase in the amount of lodgepole pine on the Swamp is expected. There would still be horse watering at Trout Creek adjacent to the campground, resulting in a continued risk of introducing noxious weeds into the stream.

Alternatives 2, 3 and 4 – Each of the action Alternatives involves use of machinery and would require fill material brought in from off-site to fill the ditches. There would be a risk of introducing noxious weeds with these actions. The risk would be greatest under Alternative 2 followed by Alternative 4. Among the action alternatives, Alternative 3 would have the lowest risk of introducing or spreading noxious weeds within the project area because the historic channels would not be excavated (less use of machinery) and there would be no soil disturbance or machinery use around the culvert. Alternatives 2 and 4 are expected to most effectively limit encroachment of lodgepole pine on the Swamp, both by the elevated water table and by active removal of trees. Some control of lodgepole pine encroachment is anticipated with Alternative 3, but control is expected to be less than under Alternatives 2 and 4 as the average water table level is expected to be lower and there will be no active removal of pine. Each of the action Alternatives would place a horse-watering trough in the

campground to prevent horses from needing to water in the Creek and in turn reduce the risk of introducing noxious weeds into the stream system.

EFFECTS ON FISH

Alternative 1 - Under the no action alternative there will be no direct effects to the fisheries resource in Trout Creek Swamp. There will be no short-term sedimentation from filling the channels, digging new channels, burning of trees or reed canarygrass areas. Sediment inputs to Trout Creek due to the culvert under the 1520 road will continue. This culvert is too small for the stream channel and is currently causing erosion downstream of the crossing. Fine sediment will continue to be flushed downstream and degrade spawning and rearing habitat over time.

Fishing pressure inside Trout Creek Swamp will likely continue at the existing levels, with most areas fished late spring/early summer when flows are higher within Trout Creek and the swamp.

Fish passage at Road 1520 will remain a barrier and therefore upstream passage of adults and juveniles will continue to be compromised and genetic interchange will be limited. Refuge habitat adjacent to and upstream of the swamp will be unavailable for juveniles and some adults downstream of the culvert, which could cause mortality in some warm, droughty years. Sediment inputs to Trout Creek because of the culvert under Road 1520 and horse traffic in the Creek will continue. This culvert is too small for the stream channel and is currently causing erosion downstream of the crossing. Fine sediment from this will continue to be flushed downstream and degrade spawning and rearing habitat over time.

Water temperature may continue to rise and flows continue to decrease over the long-term as the swamp slowly changes from a wetland to an upland forest.

Alternatives 2 and 4 - These alternatives would produce short-term fine sediment input to Trout Creek and Trout Creek Swamp due to the machine work of digging new channels, filling in the old channels, burning conifers, and burning reed canarygrass areas. After the first year and revegetation, sediment levels are expected to return to pre-project levels as fine sediments from the project implementation flush through during spring high flows. Additional fine sediment will be introduced to the system through the culvert replacement on Road 1520. There is a small possibility that sediment from the newly-created channels will continue to be produced for a couple of years before these channels are vegetated. This would increase fine sediment production over time; this sediment could reduce spawning and rearing habitat for redband trout for a year or two.

Fine sediment would be less under Alternative 4 than under Alternative 2 but more than Alternative 3, since the overall use of large heavy machinery would be less as handwork would be substituted in more sensitive areas.

Fishing pressure on Trout Creek will likely remain the same as with the no action alternative. Fishing opportunities within the swamp will be decreased due to the filling of the old channels and redirection of water to the re-established historic channels. Fishing will likely still occur during late spring and early summer near the culvert and within Trout Creek proper. Minor amounts of fish mortality would probably occur from filling of the channels within the swamp, although this would be minimized as much as possible through electroshocking and transferring of fish (see Mitigation, pgs. 13-14).

Fish passage at the Road 1520 culvert will be improved by replacing it with one that passes all life stages of fish and allows for passage of flood flows. This will allow upstream passage of adults and juveniles, and thus use of any refuge habitat adjacent to or upstream of the swamp, and will allow genetic interchange moving upstream. Fine sediment in the short term from culvert replacement will occur, although the effects will be limited to the site. Long-term effects include reduced fine sediment inputs that are currently occurring due to the undersized culvert and horse traffic in the stream. This would result in decreased bank and channel erosion downstream of the culvert and subsequently increased spawning and rearing habitat quality and success.

Water temperature will decrease in the long term because of the increased storage capacity of the swamp (see Hydrology Effects) and the resulting increase in low flows. Decreased water temperatures will likely allow for refugia for trout and increased overall survival of fish, especially during summer low flows.

Alternative 3 - This alternative is predicted to have similar effects on fine sediments as under Alternative 2 from filling created channels. However, under this alternative there will be less fine than under Alternatives 2 and 4 since the new channels would not be dug in this alternative.

This alternative is also expected to have similar effects on fish mortality as under Alternatives 2 and 4. The effect on the ability of fish to migrate up the channel will be similar to the effect under Alternative 1, since the culvert would not be replaced and would still be a barrier. There would also be continued sediment inputs to Trout Creek due from the existing culvert under the 1520 road.

Water temperature will decrease in the long term because of the increased storage capacity of the swamp and the resulting increase in low flows. Decreased water temperatures will likely allow for refugia for trout and increased overall survival of fish, especially during summer low flows.

EFFECTS ON WILDLIFE

Introduction

When comparing effects of man-induced change it is important to have a basic understanding of the natural processes and effects. Wildlife populations have been and will continue to be affected mainly by the local climate, vegetation, topography, competition, predation, and disturbance factors. The effects of man-induced change related to silvicultural and other activities proposed in the alternatives will be measured against each other. Proposed actions associated with the alternatives will be viewed in the context of their potential for effects to the process and function related to wildlife habitat.

TABLE 1 Summary of Conclusion of Effects to Listed and Special Status Species

	Wildlife	Listing	Alt. 1	Alt. 2	Alt. 3	Alt. 4
1	Northern bald eagle	threatened	NE	NE	NLAA	NE
2	Canada lynx	threatened	NE	NLAA	NLAA	NLAA
3	Northern spotted owl	threatened	NE	NLAA	NLAA	NLAA
4	Amphibians / Oregon Spotted Frog	Federal candidate	MIIH / MIIH	MIIH / BI	MIIH / BI	MIIH / BI
5	Northern Goshawk	NWFP S&M	NE	MIIH	MIIH	MIIH
6	California Wolverine	sensitive	NI	MIIH	MIIH	MIIH
7	American Peregrine Falcon	sensitive	NI	BI	BI	BI
8	Sandhill Crane	sensitive	MIIH	BI	BI	BI
9	Great Gray Owl	NWFP S&M	MIIH	MIIH / BI	MIIH / BI	MIIH / BI
10	Great Blue Heron	sensitive	MIIH	BI	BI	BI
11	Pine Marten	indicator	NI	MIIH	MIIH	MIIH
12	Townsend's Big-eared Bat	sensitive	MIIH	BI	BI	BI
13	Pileated Woodpecker	indicator	NI	MIIH	MIIH	MIIH
14	Pacific Fisher	sensitive	MIIH	MIIH	MIIH	MIIH
15	Tri-colored Blackbird	sensitive	MIIH	MIIH/BI	MIIH/BI	MIIH/BI

NE No Effect

NI No Impact

NLAA May Effect - Not Likely to Adversely Affect

MIIH May Impact Individuals or Habitat, but will not likely contribute to a trend towards federal listing or loss of viability to the population or species.

BI Beneficial Impact

Federally Listed

Bald Eagle

For Alternatives 1, 2 and 4 a determination of “No Effect” was reached because 1) the project area is greater than ½ mile line of site of any known reproductive habitat, and 2) no known winter roosts exist in the project area.

For Alternative 3 a determination of “May Effect – Not Likely to Adversely Affect” was reached because blocking fish passage without creating a new channel would reduce potential foraging habitat.

The action alternatives are fully consistent with the 2001-2003 Joint Aquatic and Terrestrial Programmatic Biological Assessment (herein referred to as the BA) for Federal Lands within the

Deschutes Basin administered by the Prineville BLM and Deschutes and Ochoco National Forests. Project design elements are consistent with all Criteria I and II in the 2001 Programmatic BA. No trees greater than 15" DBH will be felled, thinning activities will enhance the foraging potential for small mammals and upland birds, and all disturbance will be localized and easily avoided.

Alternatives 2 and 4 will not remove nesting or foraging habitat, while Alternative 3 will reduce potential foraging habitat. Trout Creek Swamp is small enough that it would not be used as a major foraging area. The effects of reducing the fisheries within the swamp would be minimal and associated with traveling individuals or incidental use. Altering the swamp to a more open condition with increased hardwoods would provide additional roost trees and number of prey species.

The action alternatives are expected to mitigate some of the previously mentioned negative effects and will have no negative cumulative effects to riparian habitats

Lynx

For all action alternatives a determination of "May Effect – Not Likely to Adversely Affect" was reached. The project area is not within an identified Lynx Analysis Unit, and no road construction is planned. Although increasing hardwoods and maintaining the riparian association are expected to enhance foraging opportunities during travel, individuals that use the project area for incidental foraging could easily avoid project activities.

Project design elements are consistent with all Criteria I and II in the 2001 Programmatic BA. Thinning activities will enhance prey habitat. All potential disturbance will be localized and easily avoided.

Existing conifer size in the swamp is above the browse line of wintering rabbits, so increasing hardwood vegetation and restoring the wet conditions is expected to increase prey availability for lynx. The project activities will be localized to the swamp and would not restrict lynx movement. Snowplowing compacts snow conditions and allows lynx competitors access further into lynx habitat. Plowing would not occur in designated habitats, but would allow increased access to higher elevation habitats.

There are several large clear cuts and numerous roads around the project area. The existing amount of human use in the area is high enough to preclude extensive lynx use. The project will not increase human disturbance or reduce habitat suitability.

Northern Spotted Owl

For all action alternatives a determination of "May Effect - Not Likely to Adversely Affect" was reached because adequate nesting, reproductive and foraging habitat exist in the Trout Creek pair's territory. Historically the immediate project area would have been a special habitat within a territory used for high-quality foraging. It still has potential to be used as foraging habitat, but would not be suitable for reproductive habitat for several decades. Foraging values of the swamp will remain after the action alternatives, and seasonal operational restrictions will be in place during critical reproductive periods.

Project design elements are consistent with all Criteria I and II in the 2001 Programmatic BA. No trees greater than 15" DBH will be felled. Thinning activities will enhance the foraging potential for

small mammals and upland birds. All disturbance potential will be localized and easily avoided.

No large-diameter trees, snags, or down logs will be removed. The swamp is currently foraging habitat, and all action alternatives will maintain this potential use.

The project area has several clear cuts in the surrounding area. Trout Creek Swamp is a unique habitat within an area designated as an LSR, so these clear cuts will be allowed to grow to large structure dominated stands. There are no expected cumulative effects from project activities or maintaining this small area in an open swamp-like condition.

R6 Sensitive, Forest Plan Indicator, and NW Forest Plan Survey and Manage (S&M) Species

California Wolverine

For all action alternatives a determination of “May Impact Individuals or Habitat” was reached. No individuals have been documented in the project area, and existing human use levels are above those typical of wolverine habitat. The project area doesn’t have potential for reproductive habitat, but could be used for foraging regardless of what alternative was selected. Individuals that use the project area for incidental foraging could easily avoid activities since there are other higher quality foraging areas close by. Snowplowing to the site to bring in fill material has the potential to allow recreational users to access areas normally not disturbed during the winter months.

Wolverines are opportunistic foragers, so changing the vegetative structure in the swamp will not affect their ability to utilize it for foraging. Increasing the wetted area and hardwoods is expected to increase the diversity and amount of potential prey. The existing level of human activity in the area is the primary limiting factor to this area being used by wolverine. The project area has potential to be used during heavy snow periods when recreational use is reduced. Snowplowing has the potential to allow increased numbers of recreationalists or to increase the distance they can further penetrate winter habitats.

Past management activities have reduced the potential of this site to be used by wolverine. The campground to the north and the road directly west of the project area are the key limiting habitat factors. The alteration of vegetative conditions and water table will have no cumulative effect to wolverine.

Greater Sandhill Crane and Great Blue Heron

For all action alternatives a determination of “Beneficial Impact” was reached. Removing conifers and increasing the wetted area will enhance security and foraging options for cranes, and activities will occur outside of potential reproductive periods. Although the project area has potential for use by these species, there has been no documentation of occurrence.

Encroachment of conifers into the swamp is having the largest effect on habitat conditions for these species. The project is expected to improve habitat by creating a more open environment. However, increased wetted areas will increase the number of amphibian species, which are prey for cranes and herons. Currently there are no documented occurrences of these species within the swamp area, and all project activities will occur outside of critical reproductive seasons.

The No Action alternative will increase the density and size of conifer trees and further reduce the amount of riparian-associated habitat that is currently below historic levels.

Throughout much of the West unique habitats are being lost to conifer invasion; allowing conifer invasion within Trout Creek Swamp would add to this problem. Removing the conifers and restoring the water table will help reverse this trend and provide migratory and potentially reproductive habitat for these species.

Peregrine Falcon

For all action alternatives a determination of “Beneficial Impact” was reached. Removing conifers and increasing hardwood will increase ease of foraging and potential prey species. Because of the lack of large vertical structures, this area’s highest potential for use is by migratory individuals that would be able to avoid project activities.

The project alternatives may directly and indirectly affect bald eagle habitat and any individuals incidentally using these habitats within the analysis area.

Throughout much of the West unique habitats are being lost to conifer invasion; allowing conifer invasion within Trout Creek Swamp would add to this problem. Removing the conifers and restoring the water table will help reverse this trend and provide foraging habitat for migrating individuals.

Townsend’s Big-eared Bat

For all action alternatives a determination of “Beneficial Impact” was reached. Removing conifers and increasing hardwoods will increase ease of foraging and potential prey species. Because of the lack of caves or buildings, this area’s highest potential for use is by foraging individuals. Foraging activities will not be disrupted by project activities due to the bat’s nocturnal foraging. There are no known hibernacula or maternity roosts within 10 miles of the project area.

Opening the meadow and expanding the wetted area will increase the amount of insect production and potential for use by Townsend’s bats. Ponds in forested habitats are used for foraging and drinking. Alternative 3 would not create ponds, whereas Alternatives 2 and 4 would. The No Action alternative will increase the density and size of conifer trees and further reduce the amount of riparian-associated habitat that is currently below historic levels.

Townsend’s bats forage in openings associated with the forested habitats. The clear cuts in surrounding area are becoming dense and tall enough to limit foraging availability. Because of this loss, areas like Trout Creek Swamp are returning to their original role as primary foraging opportunities in forested environments. Allowing the swamp to continue to become crowded with conifers would reduce the foraging potential in these areas.

Great Gray Owl

For all action alternatives a determination of “May Impact Individuals or Habitat / Beneficial Impact” was reached. Open meadow (swamp) conditions within mature forests provide primary foraging sites, and great gray owls have been seen using the swamp area. Removing the existing conifer encroachment will enhance foraging opportunities. If allowed to grow, conifers in the

swamp could reach a density and size suitable for nesting habitat, but the loss of the swamp as a foraging source would reduce the quality of the area as a whole. Foraging activities are not expected to be disrupted by project activities due to the owls' nocturnal foraging. Over-snow haul will compact the snow layer, restricting the movement of small mammal prey species.

Because of the owls' nocturnal nature, the project area will still provide foraging opportunities during construction. During winter great gray owls plunge into the snow to capture small mammals. Compacting the snow due to over-snow haul of fill would restrict movement of small mammals. The effects would be localized to one route and one season. Snowfall subsequent to the haul would restore habitat effectiveness over time. The effects are not expected to reduce the ability of individuals using the area to survive the winter.

Removing the conifer competition will have a beneficial effect to foraging opportunities for Great Grey owls, and the addition of higher-quality foraging areas will increase the surrounding habitat's suitability for reproduction.

Great gray owls forage in openings associated with the forested habitats. The clear cuts in surrounding area are becoming dense and tall enough to limit foraging availability. Because of this loss areas like Trout Creek Swamp are returning to their original role as primary foraging opportunities in forested environments. Allowing the swamp to continue to become crowded with conifers would reduce the foraging potential in the swamp.

Amphibians

For all action alternatives a determination of "May Impact Individuals or Habitat / Beneficial Impact" was reached. Alternatives 2 and 3 are expected to have incrementally greater effects due to the increase use of machinery within the swamp. The use of heavy equipment within the ditches associated with Alternatives 2 and 4 has the potential for killing individuals. Alternative 3 has similar but slightly lower potential for killing individuals. Impacts will be confined so as not to affect the entire swamp. This will allow some individuals to escape. Populations of all amphibian species are expected to survive and reestablish the following year. Restoration of natural hydrologic patterns including increased wetted area will benefit amphibian populations over time. Seasonal restrictions will cause operations to occur in the driest portion of the year when individuals have completed reproduction and would be less dispersed.

Amphibians would be directly affected by being run over by machinery driving through the swamp. The effects will be more extensive with Alternatives 4, 2, and 3 respectively, based on the type and level of mechanical use in the swamp. Alternative 4 poses the greatest risk due to the mechanical mulching of the conifers. Mechanical treatment within the ditch associated with creating ponds, building check dams, and filling in the ditch will have the potential to kill individuals. Extensive human foot travel associated with Alternative 2 also has the potential to kill individuals, but to a much less extent. Activities associated with all of the action alternatives will occur during the driest portions of the year, which will limit the number of individuals affected.

Alteration of habitats from conifer-dominated to a more open condition with increased wetted area and the construction of ponds will benefit long-term amphibian production in the swamp. The no action alternative will increase the density and size of conifer trees and further reduce the amount of riparian-associated habitats that is currently below historic levels.

Throughout much of the West unique habitats are being lost to conifer invasion; allowing conifer invasion within Trout Creek Swamp would add to this problem. Removing the conifers and restoring the water table will help to reverse this trend and provide additional habitat for these species.

Reduction of cover within the swamp will make amphibians more susceptible to predation until vegetative cover is restored. Project activities are expected to occur in the fall of the year, just prior to the period when many species of amphibians go dormant for the winter or die of natural causes.

Northern Goshawk

For all action alternatives a determination of “May Impact Individuals or Habitat” was reached. There is an active nest 1½ miles northeast of the project area. The habitats directly adjacent to the swamp have the potential to be used as reproductive habitat; these habitats will not be altered. Reducing conifers in the meadow and increasing hardwoods will increase potential prey sources. Project activities will occur outside of critical reproductive periods, and individuals that use the project area for foraging could easily avoid operations.

The project area has not been identified as a post fledging area (PFA). Altering the vegetation in the swamp would increase the diversity and number of species that would use it and thus the prey source for goshawk. Project activities will occur outside of critical reproductive periods. No large trees with nesting potential would be cut down, and snag and down log levels would be enhanced.

Past logging activities have reduced the total amount of potential nesting habitat, but created foraging areas. The swamp is a unique habitat that would have provided a high quality foraging area. Most clear cuts in the area are approaching the small pole size and are too dense to provide quality foraging habitat. With surrounding habitats being managed for LSR values, more open foraging areas will become more important to goshawk.

Pileated Woodpecker

For all action alternatives a determination of “May Impact Individuals or Habitat” was reached. The immediate project area does not have potential to be used for nesting due to the size of the trees, but the surrounding habitats do have this potential. Altering the vegetation within the swamp would reduce future large conifer trees; however, the swamp hasn’t in recent history provided that type of habitat. Surrounding habitats are within LSR designation and will be managed for late-successional habitats. Individuals that use the project area for incidental foraging could easily avoid project operations since there are other higher-quality foraging areas close by. Operational activities will be outside of critical reproductive periods.

No large trees with nesting potential would be cut down, and snag and down log levels would be enhanced. Machinery use in the swamp has the potential to disturb foraging individuals; however, there are numerous foraging areas in the adjacent area. Project activities will be outside of critical reproductive periods.

The surrounding area is being managed for Late-Successional Reserve values. Trout Creek Swamp is a small inclusion of special habitat; no cumulative effects are expected due to any of the action alternatives.

Pine Marten and Pacific Fisher

For all action alternatives a determination of “May Impact Individuals or Habitat” was reached. The project area would not be used as reproductive habitat due to the open nature and lack of large down wood. Foraging quality would be improved by maintaining the swamp in an open condition with increased hardwoods. Project activities have the potential to disturb individuals foraging in the area; however, the surrounding areas have ample habitat that could be used. Individuals that use the project area for foraging could easily avoid operations, which will be outside of critical reproductive periods. Over-snow haul of fill material has the potential to compact the snow, adversely affecting small mammal prey species, but these impacts would be localized.

Alternative 3 proposes to cut and leave the conifers, creating a jumble of small-diameter down logs. Under-the-snow habitats are the primary winter foraging habitats for pine marten. Down logs and diverse forest floor structure provide habitat for small mammal prey species. Alternatives 2 and 4 would remove or burn the trees with some piles being created on the edges of the swamp. Increasing the diversity of the area by removing conifers and increasing hardwoods would benefit pine marten prey species. Without cover in the swamp, pine marten and fisher would be more susceptible to predation if they ventured too far from the edge.

Compacting the snow by over-snow haul of fill would restrict movement of small mammals. The effects would be localized to one route and one season. Snowfall subsequent to the haul would restore habitat effectiveness over time. The effects are not expected to reduce the ability of individuals using the area to survive the winter.

Surrounding habitats are being managed for Late-Successional Reserve values, providing down logs and canopy cover for potential reproductive habitat. Pine marten forage in a variety of habitats; maintaining the swamp in open conditions with riparian associations and hardwood communities will increase the diversity of prey species available.

Tri-colored Black Bird

For all action alternatives a determination of “May Impact Individuals or Habitat / Beneficial Impact” was reached. The project area is at a higher elevation than that typically used for reproduction. Reproductive habitat would be improved by maintaining the swamp in an open condition with increased hardwoods and riparian-associated vegetation. Project activities have the potential to disturb individuals foraging in the area; however, this would be outside critical reproductive periods and easily avoided.

Alteration of habitats from conifer-dominated to a more open condition with increased wetted area and the construction of ponds will benefit tri-colored blackbird habitats in the swamp. Activities associated with action alternatives have the potential to disturb individuals using the swamp; however, the effect will be localized and of short duration. There have been no documented sightings in the swamp or surrounding areas.

The no action alternative will increase the density and size of conifers and further reduce the amount of riparian-associated habitat that is currently below historic levels.

Reduction of marsh habitats in other parts of the state and country are of greater concern than this project. All of the action alternatives will increase habitat potential for tri-colored blackbirds and provide potential reproductive and foraging opportunities for local or migrating individuals.

Big Game

Project activities associated with all alternatives will occur outside of critical reproductive activities. Removing conifer competition will enhance forage values in the area, but will reduce hiding cover within the swamp. All action alternatives will benefit habitat security by closing Road 900; this would not be the case with the no action alternative.

The no action alternative will increase the density and size of conifers and further reduce the amount of riparian-associated habitat that is currently below historic levels.

Past timber harvest in the area has resulted in clear cuts and increased road densities. Additionally, recreation activity in the area is high due to Whispering Pines campground directly north of the project area. Activities associated with the project will benefit big game habitat. Use of the swamp by deer and elk will continue to be predominantly during the night for foraging activities. If a viewing platform or educational trails are installed, there is a potential to further increase human use associated with the swamp to a point where elk would avoid the swamp. Deer and elk are currently using the swamp despite relatively high levels of human activity.

Riparian/Neotropical Migratory Birds

All of the action alternatives are expected to reduce the amount of conifer encroachment within the meadow. This will increase the water table and the potential for hardwoods. Increasing the hardwoods and amount of wetted area will also increase the potential for use by neotropical migratory birds; this would not be the case in the no action alternative. Without treatment this site will continue to become drier and dominated by conifers.

Riparian areas and special habitat features like Trout Creek Swamp have been channelized, grazed heavily, and had natural fire and beavers removed. These special habitat features are important to many species including neotropical migratory birds. Populations of these birds are declining primarily because of activities on wintering habitats in southern latitudes. Reduction of reproductive habitats in northern latitudes will increase these effects. The no action alternative would allow special habitats like Trout Creek Swamp to lose the riparian and hardwood characteristics that make it attractive for neotropical migratory birds. The action alternatives are expected to rehabilitate some of these negative effects and will have no negative cumulative effects to riparian habitats or neotropical migratory birds.

Late-Successional Reserve Habitat

The project is located within an area designated as LSR habitat. The swamp itself has historically provided a unique habitat adding to the quality of surrounding late-successional habitats. Restoring the swamp to a riparian community with hardwoods will increase habitat diversity and increase the utility of surrounding habitats.

Throughout much of the West unique habitats are being lost to conifer invasion, recreational activities, and loss of water table. Allowing conifer invasion within Trout Creek Swamp would add to this problem. Removing the conifers and restoring the water table will help to reverse this trend and increase the type and number of species that will utilize the LSR.

Snags and Down logs

The action alternatives propose to create snags by drowning or girdling existing conifers within the swamp. These snags will be between 10-15" DBH. The action alternatives also propose to place large wood within the swamp for habitat; this would not be the case with the no action alternative.

Burning activity associated with the action alternatives has the potential for escape and reduction of snag and down log levels in adjacent LSR habitats. This potential for escape is very small due to the wet nature of the swamp, location of roads, and limitation of burning to piles.

EFFECTS ON SOILS

Ditches in the swamp have altered the soil's ability to function properly and affect the hydrology of the swamp. Prior to construction of the ditches, soils in the grass and sedge areas of the swamp were wetter with water tables near or at the surface for most of the year. A history of seasonal and yearlong high water tables is evident by the bright colored soil mottles in the soil profiles of the swamp. Soil taxonomy refers to these mottles as "redoxomorphic" soil features and uses them to identify soils with seasonal or yearlong water tables. Evidence of a current dryer soil environment is also supported by the fact that much of the vegetation types currently supported by the meadow area typically do not occur in a wetter environment that once existed as indicated by the soil morphology observed.

Locations of the ditches and the water moving through them differ from where the channels were historically. The ditches are also straighter than the historic channels, causing water to move more quickly off the meadow.

Alternative 1 - Under the No Action alternative there will be no direct affects resulting from machines and or hand crews working in the swamp. Disturbances, such as soil compaction mainly from historic grazing, will remain at current levels. Soil erosion, mostly from gully erosion, and resulting sedimentation will continue at its current rate. Soil water table levels will likely continue to drop lower and the swamp will continue to dry up over time. This will be caused by continued gully erosion in the existing ditches, allowing water to be drained from the swamp at an increasing rate over time. Conifer trees will continue to invade the meadow areas of the swamp, trees will continue to grow larger, and the water table will be lowered through transpiration of water by the trees. The long-term result will be continued drying of the swamp area and a gradual change from a swamp to an upland forest.

Alternative 2 - Filling the ditches originally dug to drain the swamp will slow the movement of water thorough the soils, increase water storage, raise the water table, and allow the natural hydraulic conductivity of water through these historically saturated soils.

Although the water table has been lowered in the swamp, vegetation in the form of grasses, sedges and forbs are adequate to mitigate surface erosion that may result from sheet and rill soil erosion once the water table is raised. Therefore only the hazard of gully or in-stream soil erosion is of concern, except in small areas disturbed by filling the ditches. Historic channels are still visible on aerial photos. Some actions may be necessary to reestablish historic channels; however, if channels are not kept small, there is a risk of lowering of the water table by channels that are larger than historic ones.

Removal of encroaching lodgepole pine in the meadow area of the swamp would help to increase the water tables in the soil to the desired levels by eliminating some of the water loss through transpiration of trees. Impacts to soils by hand felling trees, hand pilling and then burning will be minimal as long as proper mitigation measures are followed to avoid periods of wet soil conditions. Work could either be done over adequate snow or later in the fall when the swamp is drying out.

Alternative 3 - Ditches that are partially obstructed with check dams and some fill may be less effective at restoring the function of the soils, and in turn the hydrology of the swamp, than if ditches were filled, as proposed under Alternatives 2 and 4. However, this alternative would slow the water flow through the ditches rather than spreading across the meadow. Surface water evaporation may also be a factor depending on the size of the ponds created in the ditches.

Removal of encroaching lodgepole pine in the meadow area of the swamp would help to increase the water tables in the soil to the desired levels by eliminating some of the water loss through transpiration of trees. Slowly killing the lodgepole pine by increasing the water table may also produce the same result provided the water table is high enough to accomplish the desired result. There is a risk under this alternative that at least some trees may continue to survive and as they grow the amount of water they transpire could inhibit rising of the water table. Organic matter provided by the dead trees decomposing on site would be minor when compared to soil organic matter provided by the grasses and sedges on the site. Therefore, increased soil organic matter and associated plant nutrients should not be considered a benefit of leaving the trees on site to decompose.

Alternative 4 - Effects resulting from actions proposed in Alternative 4 would be the same as Alternative 2 with the exception of the way in which channels may be constructed. The use of machines such as a spider backhoe to dig small channels will result in some additional soil compaction and disturbance in the swamp. Excessive foot traffic can also result in additional soil compaction and disturbance in the meadow areas of the swamp. Although some impacts to soils would occur, it is difficult to predict whether one method will have less impact than another. In regard to minimizing impacts to soils, Alternative 4 leaves more options open to use a method that appears to have the least impacts at the time of implementation than does Alternative 2.

EFFECTS ON RECREATION AND SCENIC RESOURCES

Recreation Resources

Alternative 1 – This alternative is not expected to affect recreation facilities or activities. There would be no impacts of noise or inconvenient access for recreationists under this Alternative.

There would be no change in the access to fishing in the ditches, but there may be continued decline in the quality of fish habitat in the ditches and in the creek as sedimentation and erosion continue. There also would be no potential enhancement of fish habitat and, indirectly, fishing quality in Trout Creek proper.

Without the horse-watering trough, campers would still need to bring their horses over to Trout Creek to get water.

Alternatives 2, 3 and 4 – Under the action alternatives there may be a short-term interruption to access the campground along Forest Road 1520 from the west while the culvert is being replaced (about 1 week), but good access would still be available along 1520 from the east. Mitigation measures will result in the detour being well signed along the alternative access routes (see mitigation measures on pgs. 13-14). Timing the culvert replacement for mid-September would minimize the number of recreationists who would be affected. (Campground use is fairly low after Labor Day and prior to rifle hunting season.)

The addition of a watering trough for horses in the campground would increase the convenience for horse owners, since they would not need to bring their stock down to the creek.

During implementation of the swamp restoration there would be increased impacts on recreationists from the noise of machinery, but these effects would be short-term.

The opportunity to fish in the ditches within the swamp would eventually be eliminated under the action Alternatives, since the ditches would be filled in. However, it is expected that fish would eventually use the shallower re-established historic channels. Improved fish habitat is expected to improve fishing quality in Trout Creek proper as sediment and erosion are reduced, water levels increase, and water temperatures decrease through restoration efforts.

Scenic Resources

Alternative 1 – The swamp would continue to close in as lodgepole pines encroach; over the long term the diversity of scenery in the landscape would decrease.

Alternatives 2, 3 and 4 – Under all of the action alternatives the swamp would gradually open up, enlarging the area of visible meadow and increasing the diversity of scenery in the landscape. Higher water tables would likely result in greener vegetation later in the year. Reduction of reed canarygrass and a predicted increase in native vegetation would increase the diversity of textures and colors in the swamp.

EFFECTS ON HERITAGE RESOURCES

Alternative 1 – There would be no effects on the heritage resources located in and around the campground, because there would be no ground disturbances from culvert replacement or development of a watering trough for horses.

Alternatives 2, 3, and 4 – Under each action alternative, placement of the watering trough in the campground would include shallow excavation for a pipeline from Trout Creek to the tank (about 120 meters). The pipeline would skirt the western edge of the cultural site and may result in potential disturbance. Under alternatives 2 and 4, the culvert under Forest Road 1520 would be replaced. This action would also cause potential impacts to the cultural site, but monitoring the site during project implementation for tools, features or flake concentrations would help mitigate potential effects.

EFFECTS ON OTHER RESOURCES

Late-Successional Reserve

Alternatives 2, 3 and 4 are consistent with recommendations in the Why-chus LSR Assessment because they all restore the hydrologic functioning of Trout Creek Swamp. Alternative 1 is not consistent with the LSRA.

Prime Lands

This parcel is not classified as prime forest, farm, or rangelands. There would be no direct, indirect, or cumulative effect to these resources.

Social Factors

There would be no known direct, indirect, or cumulative effects on Native Americans, minority groups, women, or civil rights because of any alternative.

Flood Plain Management and Protection of Wetlands

The project is intended to improve the function and quality of an existing wetland. There would be a minor net gain in area of functioning wetland.

Compliance with State and Local Laws

All alternatives are consistent with state and local laws, and environmental policies.

Environmental Justice

The proposed project is not located in a minority community; therefore the project would not pose a disproportionately high or adverse affect to those populations.

LIST OF PREPARERS AND CONSULTATION WITH OTHERS

This section identifies the Forest Service personnel who participated in the environmental analysis and the preparation of the EA. For a list of organizations and individuals contacted during the scoping process, refer to the Project File located at the Sisters Ranger District.

Interdisciplinary Team

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Rob Tanner, and Marc Wilcox – Hydrologists

Terry Craig – Soil Scientist

Dan Rife – Fishery Biologist

Monte Kuk - Wildlife Biologist

Rick Dewey – Botanist

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REFERENCES

- Banci, V. 1994. Wolverine. In: Ruggiero, Leonard F.; Aubry, Keith B.; Buskirk, Steven W. [and others], technical editors. 1994. The scientific basis for conserving forest carnivores: American marten, fisher, lynx and wolverine in the Western United States. Gen. Tech. Rep. RM-254. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 7-37. Chapter 2.
- Bull, E.L., R.S. Holthausen, and M.G. Henjum. 1990. Techniques for pileated woodpeckers. USDA Forest Service, Gen. Tech. Rep. 269.
- Bull, E.L. 1975. Habitat utilization of the pileated woodpecker, Blue Mountains, Oregon. M.S. Thesis, 58 p. Oregon State University.
- Butts, T.W. 1992. Wolverine (*Gulo gulo*) biology and management: a literature review and annotated bibliography. Pages 31-33. USDA Forest Service, Northern Region.
- Csuti, B., A.J. Kimerling, T.A. O'Neil, M.M. Shaughnessy, E.P. Gaines, and M.M.P. Huso. 1997. Atlas of Oregon Wildlife. Oregon State University Press, Corvallis, OR. 492 p.
- Hornocker, M.G. and H.S. Hash. 1981. Ecology of the wolverine in northwestern Montana. *Canadian Journal of Zoology*. 59(7): 1286-1301.
- Larsen, D.M. 1976. Soil Resource Inventory: Deschutes National Forest, Pacific Northwest Region.
- Reynolds, R.T. et al. 1991. Management for the northern goshawk in the southwestern United States. USDA Forest Service, Southwest Region.
- Straw, D. and M. Riehle. 1990. Trout Creek Survey Summary, unpublished report, Sisters Ranger District, Deschutes National Forest.
- Terres, J.K. 1991. The Audubon Society Encyclopedia of North American Birds, ISBN 0-51703288-0. Page 938.
- USDA Forest Service, 1998 - 2001. Sisters Ranger District Survey files.
- USDA Forest Service. 2001. Joint Aquatic and Terrestrial Programmatic Biological Assessment for Federal Lands within the Deschutes Basin Administered by the Bureau of Land Management Prineville Office and For Federal Lands Administered by the Deschutes and Ochoco National Forests. April 30, 2001.
- USDA Forest Service. 1990. Land and Resource Management Plan. Deschutes National Forest.
- USDA Forest Service. Pacific Northwest Region. 1988. General Water Quality Best Management Practices.
- USDA Forest Service, Deschutes National Forest. 1996. Metolius Watershed Analysis, Deschutes National Forest.
- USDA Forest Service, Deschutes National Forest. 1998. Sisters/Why-chus Watershed Analysis, Deschutes National Forest.

USDA, Forest Service, 1990. Land Management Plan, Deschutes National Forest Final Environmental Impact Statement

USDA, Forest Service, USDI, Bureau of Land Management, 1994. Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl; and Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth forest Related Species Within the Range of the Northern Spotted Owl. Final Environmental Impact Statement

Wisdom, Michael J. et al. 2000. Source habitats for terrestrial vertebrates of focus in the interior Columbia basin: broad-scale trends and management implications. Volume 1--Overview. Gen. Tech. Rep. PNW-GTR-485. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 3 vol. (Quigley, Thomas M., tech. ed.; Interior Columbia Basin Ecosystem Management Project: scientific assessment).